GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

DEFENSE DIGEST · 76
HANDBOOK ON FANS · 87
MOTOR CONTROLS · 122

Power

October
1951 · 50¢

A McGRAW-HILL PUBLICATION

Give enough!

Controls handle coal and gas in cyclone furnaces — p 71

We'll do it the best way

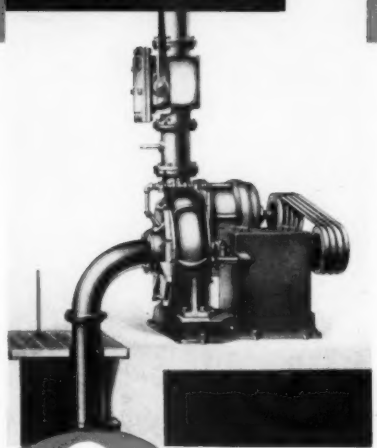
PNEUMATIC

Fly-ash hopper in one of the nation's major power stations, showing A-S-H air-electric operated dust valve.

JETTING

High pressure sluice water discharging ashes at about 130 feet per second. Cover plates removed from sluiceway.

PUMPING



Detail of typical transfer sump arrangement, with Hydroseal Pump on basement floor.

There are many different ways to move ashes out of your plant, but one method is best . . . best for you, that is, because it fits your requirements like a glove. An A-S-H engineer can tell you what that method is; he isn't sold on any particular system, since A-S-H has been installing all types and combinations for more than a quarter of a century. Here are some of the factors he considers:

Type of furnace involved
Method of final disposal
Space available
Water available
Steam available

Both fly ash and furnace bottom ash can be handled pneumatically or hydraulically, and the A-S-H engineer may advise a combination of the two, depending on conditions. Your system may involve pumping or jetting to a fill area, to a grab-bucket sump, or to overhead storage. Or, your ash may be transported pneumatically to a silo for dry storage and conditioning. The ash can then be disposed of in cars or trucks.

To get the best ash handling system for your plant, get the best advice at the very beginning. Write us.

A-S-H

THE ALLEN-SHERMAN-HOFF CO.

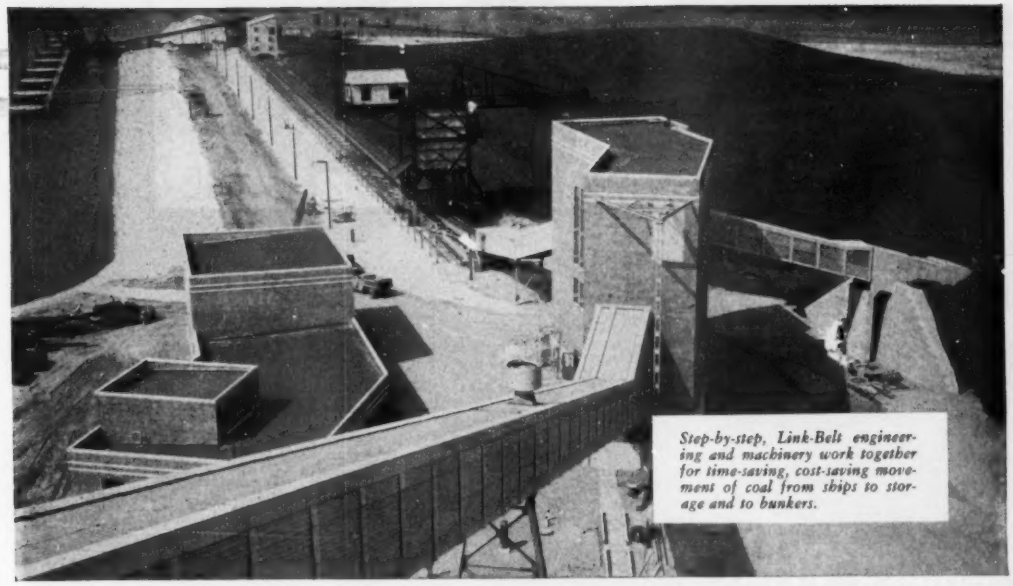
Dept. A—259 E. Lancaster Ave., Wynnewood, Pa.

Offices and Representatives in Principal Cities

HYDROJET (hydraulic) HYDROVAC (pneumatic)

materials handling systems

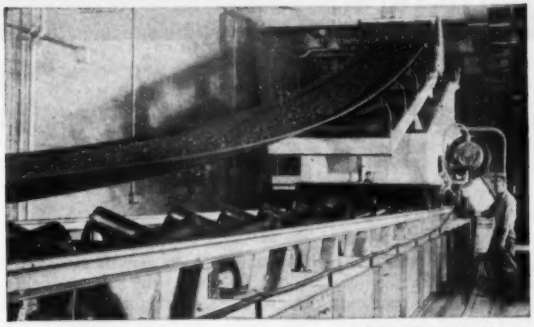
LINK-BELT engineering...



Step-by-step, Link-Belt engineering and machinery work together for time-saving, cost-saving movement of coal from ships to storage and to bunkers.

LINK-BELT equipment...

...combine to cut coal handling costs — from unloading to delivery to power plant bunkers



Link-Belt answers a vital need for the more efficient handling of coal in power plants—large and small. Here a Link-Belt Belt Conveyor and motor-operated traveling tripper distribute coal to bunkers through a dust-tight bin seal.

You name your coal handling problem—look to Link-Belt for the answer! Based on experience gained in hundreds of installations in power plants everywhere—Link-Belt has the facilities, the proven equipment, the engineering know-how to carry the ball from start of operations planning to delivery of coal. Regardless of the size of your plant—Link-Belt engineers can recommend exactly what you need for more efficient coal handling.

Conveyors, elevators, feeders, car dumpers and shakers, screens, hoists, hoppers, chutes, gates, stackers, unloading towers, weigh larries and related power plant equipment and accessories—all can be supplied by Link-Belt—*the most complete line* in the field.

So for simpler, more efficient, increased capacity coal handling methods—lower operating and maintenance costs—call on Link-Belt.

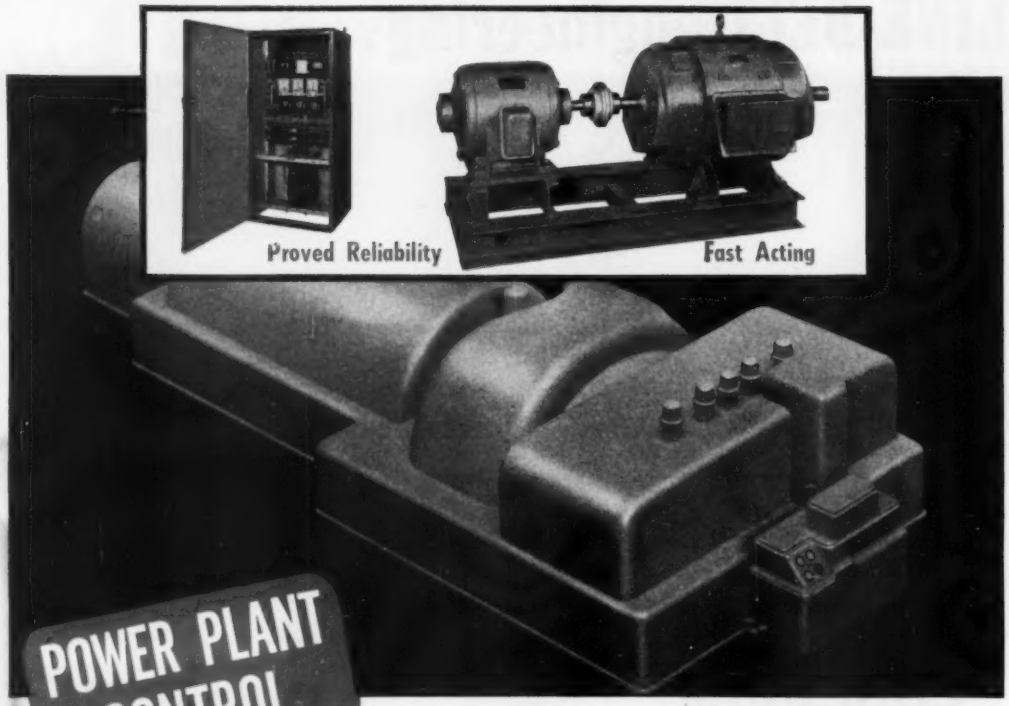
Our engineers will cooperate with you or your consultants to find the most economical solution for your problems. Write for details.

12.204

LINK-BELT COMPANY Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg. Offices in Principal Cities.

LINK-BELT

COAL HANDLING EQUIPMENT



POWER PLANT CONTROL *Regulex* Rotating Voltage Regulators!

FOR FAST, ACCURATE, reliable control of large generators, select *Regulex* voltage regulators. The regulator's output, connected in series with the self-excited main exciter shunt field, aids or bucks excitation . . . maintains accurate line voltage.

IMPROVES SYSTEM STABILITY

You get both regulation and maximum stability from old or new generating equipment by using the *Regulex* rotating regulator. During transient loads, high amplification and fast response force the generator field current to reach the required value for stability quickly — quickly enough to keep the machine in synchronism through most faults. Its quick voltage recovery and limited overswing further aid generator stability.

AND RELIABILITY

The *Regulex* voltage regulator consists of two parts: 1) the control cubicle which contains only static devices and requires no maintenance; 2) the *Regulex* rotating amplifier which is essentially a dc generator and requires no more maintenance than a normal exciter. No special training of maintenance personnel is required.

Call your nearby A-C representative for more information, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Regulex is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-3458

Order Telegraph Systems

The Allis-Chalmers Order Telegraph System is accurate and reliable . . . can be depended upon even during station power failure because it uses the dc bus for its power source. An alarm system operates until the order is returned correctly. Five or ten inch semi-flush dials for switchboard mounting. Use it to transmit orders between switchboard and turbine room.

Automatic Speed Control for Boiler Draft Fans

Draft fans operate at exactly the required speed for perfect combustion when Allis-Chalmers Type 257 Liquid Rheostats are used with wound rotor drive motors. They are application engineered to provide straight line speed characteristics . . . automatic wide range stepless speed control. Use electric, pneumatic or hydraulic pilot devices. Ask for leaflet 14S7544.

Power

OCTOBER 1951 VOLUME 95 NO. 10

combined with Operating ENGINEER

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POWER (with which are consolidated *Science and Industry, The Engineer Review, The Engineer, The Stationary Engineer* and *Operating Engineer*) is published monthly with an additional directory number in June, by McGraw-Hill Publishing Company, Inc., James H McGraw (1860-1948), Founder. PUBLICATION OFFICE: McGRAW-HILL BUILDING, 330 W 42ND ST, NEW YORK 18, N. Y.

EXECUTIVE, EDITORIAL and ADVERTISING OFFICES: 330 W 42nd St, New York 18, N. Y. Curtis W McGraw, President; Willard Chevalier, Executive Vice-President, Joseph A Gerardi, Vice-President and Treasurer; John J Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B Smith, Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J E Blackburn, Vice-President and Director of Circulation.

SUBSCRIPTIONS: Address correspondence to POWER, Subscription Service, 330 W 42nd St, New York 18, N. Y. Allow ten days for change of address. Please indicate position and company connection on orders. Single copies 50¢. Subscription rates—U. S. and U. S. possessions: $4.00 for one year, $6.00 for two years. Canada: $6.00 for one year, $10.00 for two years. All other countries: $15.00 for one year, $25.00 for two years. Entered as second-class matter January 26, 1949 at the post office at New York, N. Y. under Act of March 3, 1879. Printed in U.S.A.

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POWER articles are indexed in both the *Industrial Arts Index* and the *Engineering Index*. POWER publishes its own index annually, copies of which are available on request to the editorial offices.

CONTROL ROOMS of today's power stations stand out as symbols of the modern spirit in plant design. Even to the layman, they carry the ideas of efficiency, automatism and precision. Bright with modern lighting, comfortably air-conditioned, they are literally shining examples of the revolution that has swept away the power plants of old—dark caverns peopled with sweaty and begrimed toilers—and raised power generation to new levels of productivity.

Unusual control-room photo on our cover, taken at Michigan City Generating Station, stands for more than this. Handling combination firing of coal and gas in cyclones (p 71), it speaks as well for the continuous progress that marks the dynamic field of instrumentation and control.

Next Month . . .

■ If you think of Oak Ridge as a center of nuclear knowledge, you may be surprised to learn, by way of a November article, that it's also a good source of comparative data on fuel performance—coal, oil, gas—from the angle of economics as well as operation.

■ Watch for more practical dope on diesel alarm systems by Ed Kates and on water softeners by Paul Brindisi.

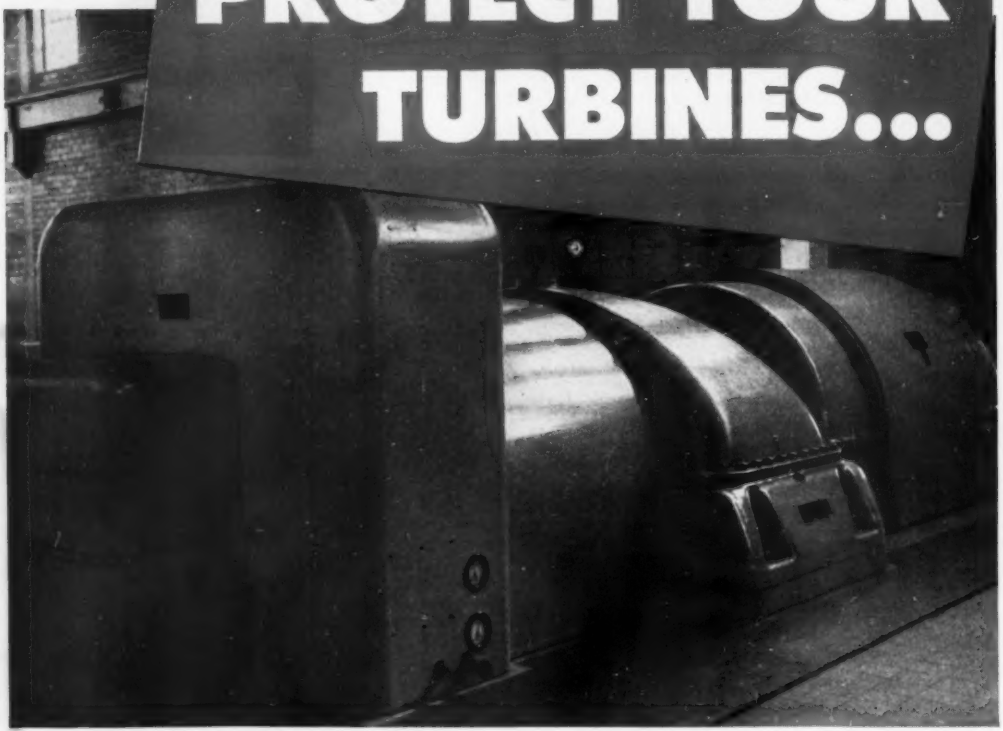
■ New charts for common types of pipe bends give stress, deflection and anchor force with almost no computation, should prove a welcome timesaver for garden-variety jobs.

■ In Sept (p 5) we told you how Associate Editor Steve Elonka learned the fine points of eutectic welding. The next *Operator's Notebook* starts passing along this practical know-how by giving the basic information you need to apply this maintenance method in your plant.

. . . and future months

■ You'd have to hunt hard to find a subject of direct interest to more engineers than *bearings and lubrication*. That's why we're sparing no pains to make our 32-page December special section the kind of hard-hitting practical reference you want to cope successfully with problems in this field. Keep an eye peeled for it.

PROTECT YOUR TURBINES...



Keep 'em rust-free, sludge-free and foam-free with TEXACO REGAL OIL (R&O)

IT MAKES no difference what the size of your turbines . . . or whether they're steam or hydro. *You can't buy better lubrication than Texaco Regal Oil (R&O)!*

Texaco Regal Oil (R&O) is made from top-grade stocks, specially refined and processed. Special Texaco additives make it *more than ten times as resistant to oxidation* as ordinary turbine oils . . . assure vastly increased protection against rust. *Texaco Regal Oil (R&O)* will not foam.

You can count on *Texaco Regal Oil (R&O)* to give an extra-long service life . . . to keep bearing temperatures normal, governor response instantaneous. There is a complete line of *Texaco Regal Oils (R&O)*—a viscosity for every requirement. They meet the stringent requirements of all leading turbine builders.

Let a Texaco Lubrication Engineer work with you to increase efficiency and reduce costs throughout your plant. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL TURBINES

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.

Power

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...with Power readers...

DOUBLE CHECK . . .

Thank you very much for the check for $15 for my contribution to "Biggest Boner." Will you please send me three or four tear sheets of this article.

For some reason I received two checks for $15 each. I am returning check No. 42487 to you.

Chilocco, Okla. EDGAR SCROGGINS

Although the Office Cynic was heard to mumble something about "his biggest boner was sending back the extra check," we sincerely appreciate contributor Scroggins' honest retrieve of what seems to have been a "boner" in our record keeping.—*Ed.*

LEMONS AGAIN . . .

In August POWER *a letter from John J Bacica calls attention to an error in Part One of the Power Handbook.*

It seems to me there is also an error on page 94 in the paragraph on single-phase power. You state that $VARS = V - A\sqrt{(1-pf^2)}$. *Shouldn't this be* $VARS = V - A\sqrt{(1-pf^2)}$? *Also on p 92, in the illustration on voltage induction in conductors, wouldn't it help to indicate the polarity in the drawing?*

I look forward to reading your publication every month.

Cedar Rapids, Iowa JACOBUS GORTER

(*Continued on page* 216)

...lines and bylines

25-YEAR CLUB for POWER contributors hasn't been formed yet, but when it is, Terry Mitchell will qualify hands down. Long-time readers know him for his many practical articles on various phases of refrigeration (p 116, for example) but may not know, as do POWER staffers who receive his unique Christmas cards, that he's also an accomplished artist and historian.

Terry Mitchell

His oil and pastel paintings have been exhibited often and he combined his hobbies in a book of pen sketches of old Cumberland Valley houses.

A native of Richmond, Va., Terry took arts and science courses at the universities of South Carolina and Richmond before starting in engineering at Delaware. As a cadet pilot in World War I, he trained at Cornell and U of Texas. After completing additional engineering work at MIT in 1921, he entered the Westinghouse training course. But he preferred mechanical things to electrical and went to Frick Co of Waynesboro, Pa., where, for 30 years, he has held a variety of engineering, sales, training and publicity assignments.

Annett and plaque

ANNETT STORY PS: Biggest moment at luncheon honoring Fred Annett on his "retirement" from POWER was gift of plaque designed by staff artist Van Gorp and carved by Elmer Tangerman, former POWER managing editor. Symbolizing Fred's career and interests (see p 71, Aug), it carried a silver plate with engraved signatures of more than 60 of Fred's McGraw-Hill friends.

Quotes on "retirement" are deliberate—an Annett article appears in this issue (p 78), others are on the way.—Ed.

FANS AND MORE FANS have been Tyler Hicks' steady diet for months past as he prepared the condensed handbook beginning on p 87 of this issue. It all started more than a year ago.

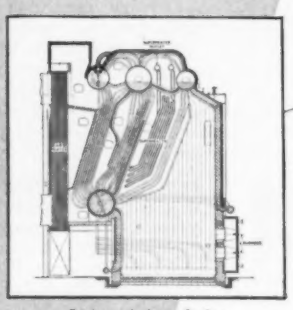
Tyler Hicks

That's when we laid out our schedule for 1951 special sections. Ty's first step was to get in touch with fan engineers for latest information. After he'd steeped himself in their data and the standard references, he knew what should go into the handbook, had some ideas on good ways to present it for easy reading. In a series of huddles with Charlie Marschalek and Bill Arrott, these ideas took definite shape in the form of page layouts.

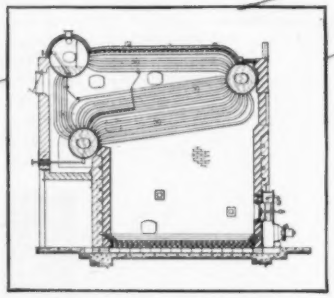
Then all Ty had to do was oversee illustration work, write text and captions, check everything. Finally, to make sure the job was on the beam, he took it under his arm to get comments from authorities in the field. Some ten days and 3000 miles later, he was back with fine points nailed down and an itch for a few days' vacation. Take a look at his job to see if he deserved them.

LOW-COST STEAM

is a "family" affair at B&W

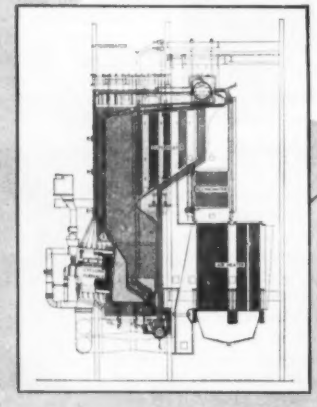


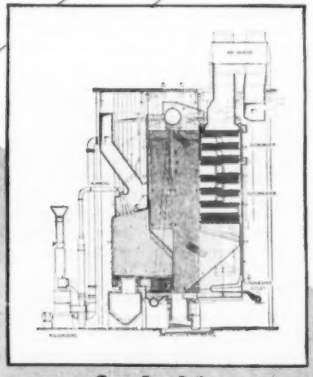
Stirling 4-drum Boiler.



Type H Stirling Low-Head Boiler.

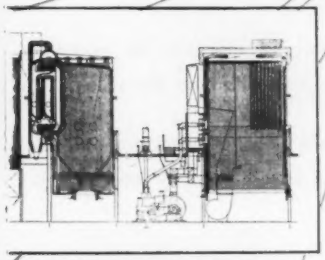
Radiant Boiler



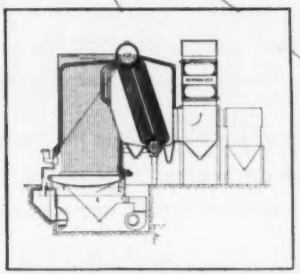


Open Pass Boiler.

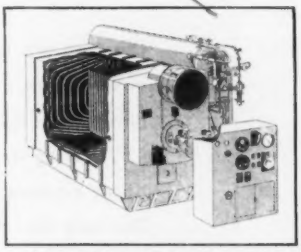
BABCOCK & WILCOX



Integral-Furnace Boiler, Type FH.

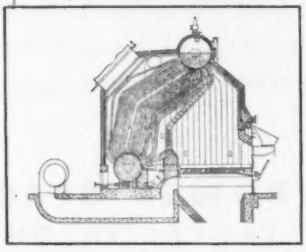


Integral-Furnace Boiler, Type FL.

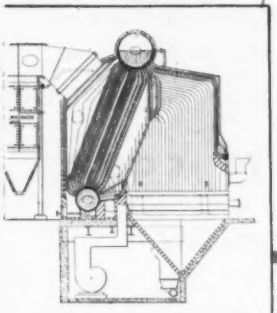


Integral-Furnace Boiler, Type FM.
(SHOP-ASSEMBLED)

Integral-Furnace Boiler, Type FF.



Integral-Furnace Boiler, Type FJ.



In the development of boiler designs, B&W's pioneering innovations during the last 70 years parallel and reflect an increasingly wide variety of user-requirements. Today, B&W offers an integrated "family" of service-tested boiler designs from which it is possible to select a steam-generating unit to satisfy virtually any requirements.

Shown here, for example, are current versions of some popular B&W boiler designs. Units of these types have been installed spanning a range of steam capacity from 2,800 to 1,370,000 lb. per hr.; final steam temperatures to 1050 F.; and boiler design pressures to 2650 psi.

In each of these types, standardization has been carried forward to the furthest possible degree commensurate with the necessarily diverse requirements of central station, industrial, and non-industrial operating practice. B&W Sales Engineering, established upon this broad base of design categories, is able to bring the most considerate and unbiased attention to your particular steam-generating problem—an approach essential to realizing the advantages inherent in whatever type of boiler is best suited to your operation. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

G-5497

DIAMOND Soot Blowers

The greater emphasis being placed on high boiler availability indicates the equal importance of high soot blower availability. The first can be limited by the second.

No other power plant equipment takes the "beating" to which soot blowers are daily subjected. Elements are exposed to repeated, sudden and severe thermal shock . . . to extremes of temperature, erosion and corrosion.

Diamond has long paid particular attention to "high availability" in its research . . . in the design, in the selection of materials and in the manufacture of all Diamond Soot Blowers. That they excel in this direction also is attested by their performance records . . . and by the preference they have long enjoyed among the most critical users of boiler equipment. The next time you need soot blowers, it will pay you well to select Diamond Soot Blowers.

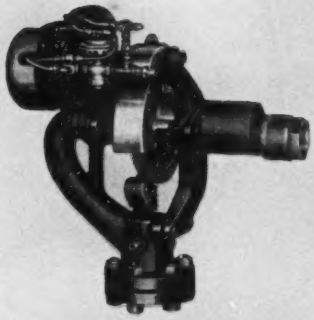
DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited • Windsor, Ontario

DIAMOND Model IK Long Retracting Soot Blower with mechanically operated valve. Air motor operated unit shown; also available electric motor operated.

There is a DIAMOND Soot Blower___

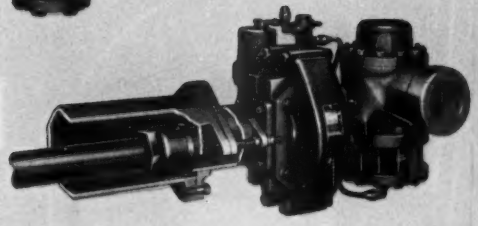
meet the challenge of

HIGH BOILER AVAILABILITY

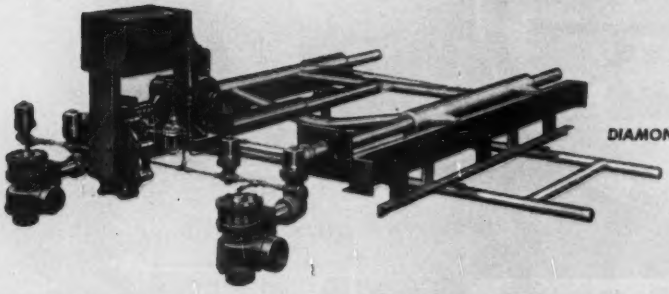


DIAMOND Model G9B Soot Blower. Air operation shown; also available for manual or electric operation.

DIAMOND Model IS Short Retracting Soot Blower. Electric operation shown; also available for manual or air operation.



DIAMOND Model A2E Automatic Air Puff Soot Blower.



DIAMOND Automatic Air Heater Blower.

4589

... for Every Boiler Cleaning Requirement

• A 975,000-lb-per-hr vertical deaerating feedwater heater, mounted on its horizontal storage tank.

• Workmen fitting and welding internal baffling in a deaerating heater shell.

• Scarfing a head, preparatory to fit-up and welding.

ELLIOTT!

...from drawing board...to hydrostatic test

ELLIOTT
Deaerating Heaters

are (and always have been) distinctly and strictly an Elliott product, built throughout in Elliott shops to insure the positive and reliable performance that Elliott engineering has designed into them. We *know* every detail is *right*, before a unit is shipped, and that it will live up to the full expectations of ourselves and of its purchaser.

Elliott deaerating heaters require no maintenance. The tubular vent condenser of older designs is now replaced with an inlet spray unit and vent collecting hood located within the shell. Trays are of fabricated stainless steel. Non-corrodible metals are used wherever undeaerated water touches the metal. These are some of the latest developments in deaeration, fully covered in Bulletin N-16. Write for a copy.

ELLIOTT COMPANY
Deaerator and Heater Dept.
JEANNETTE, PA.

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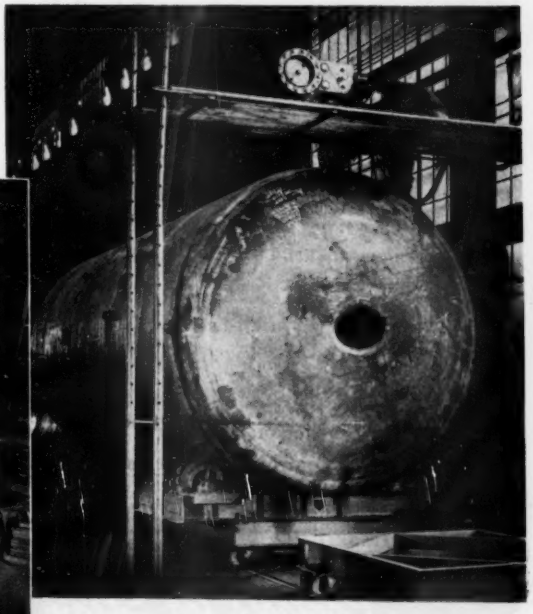
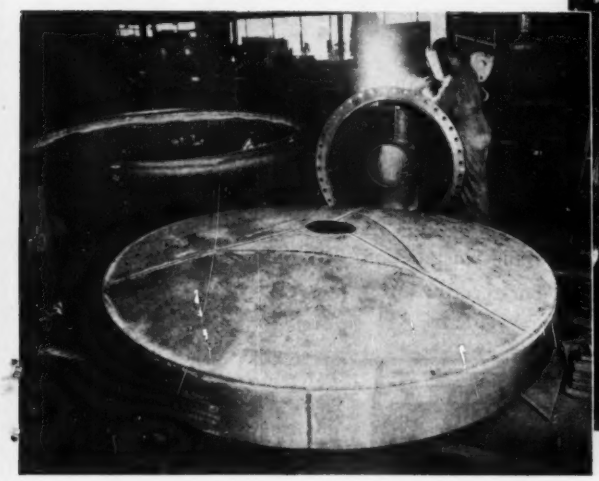
HALF CENTURY OF POWER PROGRESS 1901 1951

N-1002

• A.S.M.E.-approved automatic welding is used wherever possible in fabricating deaerating heaters and storage tanks.

• Below, a stainless steel inner head.





How to the Efficiency Boiler-Room

Before you get steam you've got to spend dollars—so dollars are a form of energy.

And if your boiler-room dollars are invested in equipment that isn't working efficiently, economically, your "investment" is poor.

That's where co-ordinated controls by Bailey can help. Here's why they'll increase your "boiler-room investment efficiency":

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service—conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

•

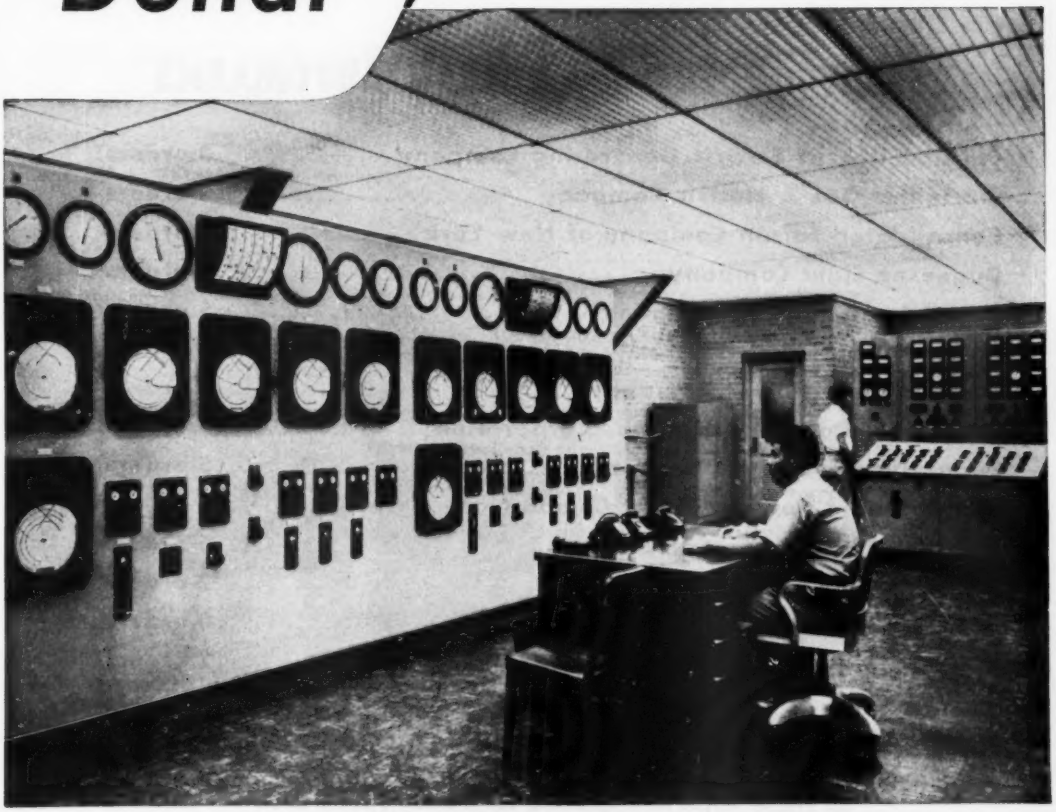
For better "boiler-room investment" efficiency—for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

111-1

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

INCREASE of YOUR Dollar



These Bailey Boiler Controls for Combustion, Feed Water, and Steam Temperature insure efficient operation of two 450,000 lb per hr, 1000 psi, 900 F, gas and oil fired boilers.

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO

BAILEY METER COMPANY, LIMITED • MONTREAL, CANADA

REPEAT

are the "Proof

REPEAT ORDERS for VULCAN AUTOMATICS

Chicago District Electric Generating Company	3 orders
Cincinnati Gas & Electric Company	2 orders
Consolidated Edison Company of New York	8 orders
Duquesne Light Company	3 orders
Long Island Lighting Company	5 orders
Metropolitan Edison Company	3 orders
Monongahela Power Company	2 orders
New York State Electric & Gas Corporation	2 orders
Pennsylvania Electric Company	5 orders
Pennsylvania Power & Light Company	3 orders
Philadelphia Electric Company	5 orders
Public Service Company of Indiana	2 orders
Rochester Gas & Electric Company	4 orders
Staten Island Edison Company	2 orders

"Proof of the Pudding" lies in repeat orders placed by these important utilities for Vulcan Automatics.

VULCAN *Automatic*

ORDERS of the Pudding"

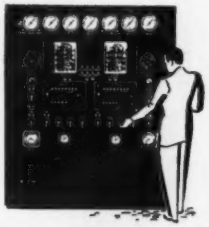
You might try something new because you believe it good. But you don't often buy it again until you've had proof that performance lives up to promises.

So it was with the important central stations on the list. They tried Vulcan Automatic Soot Blowing Systems on faith. They placed repeat orders after experience had proved that Vulcan would:

1) Clean boilers better because the system is engineered for effective blowing in even the least accessible passes. This means higher boiler efficiency, less fuel burned per pound of steam generated.

2) Use less steam or air in blowing because each boiler operates for exactly the proper cleaning interval and no more. Saving steam or air saves money.

3) Save labor because the entire system is operated by pushing one button at the panel. This frees men for other duties, improves operation and cuts operating costs materially.

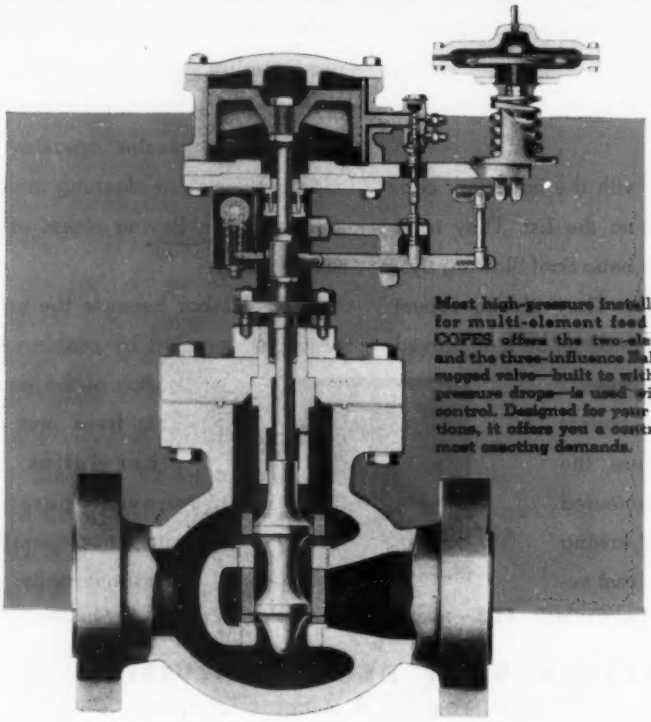


Write for Bulletin 483—the story of modern Vulcan Automatics

VULCAN SOOT BLOWER DIVISION
Continental Foundry & Machine Company
DUBOIS, PENNSYLVANIA

COPES

To Control FEED WATER



Most high-pressure installations today call for multi-element feed water control. COPES offers the two-element Flowmatic and the three-influence Balanced Flow. This rugged valve—built to withstand unlimited pressure drops—is used with both types of control. Designed for your operating conditions, it offers you a control ideal for your most exacting demands.

COPES

BOILER FEED

was FIRST
. . . Over 1000 P. S. I.

It was in 1919—almost ten years before an American boiler reached such high pressure—that COPES was first used successfully to feed a boiler operating at a pressure of more than 1000 psi. Two European installations were made that year through a British boiler company. The experience made COPES the logical choice for the first 1400-psi boilers ever to be installed in this country.

Today, associates in England, France, Austria and Italy help keep COPES abreast of boiler developments everywhere. Recommendations you receive from COPES engineers are thus backed by world-wide experience. Call on these regulation specialists for help with your toughest jobs.

NORTHERN EQUIPMENT DIVISION

Continental Foundry & Machine Company

1011 GROVE DRIVE, ERIE, PENNSYLVANIA

***Headquarters for* Feed Water Regulators, Pump Governors, Differential Valves, Level Controls, Hi-Low Alarms, Reducing Valves, Desuperheaters**

WATER REGULATION

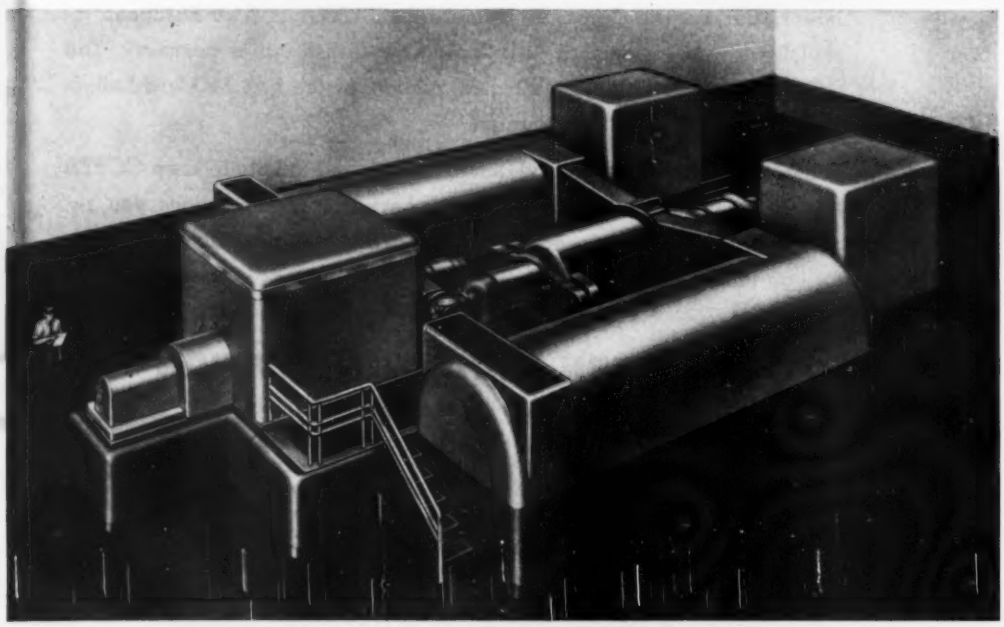
NEW WAY TO HANDLE DEMAND

Power companies, compelled to meet sudden new load demands from defense industries in outlying territories, may find the answer to their problem in the simplicity of General Electric gas turbines. Gas turbines, though they stand on their own feet as far as economy of power generation is concerned, also offer unique advantages for service in end-of-the-line plants.

For example, a gas turbine is easily and quickly installed. There's no massive foundation to worry about, and the building which houses the unit can be of the simplest construction. Furthermore, a gas turbine-generator is easy to operate—it offers the excellent possibility of modification for remote operation in the future. If load demands change, the design of the gas turbine makes moving to a new location a practical, inexpensive operation.

Several utilities, recognizing these distinctive gas turbine advantages, have ordered units to firm up service in outlying territories. If you have a similar problem, why not investigate this possibility yourself? A General Electric turbine specialist in your nearby sales office will discuss the application in the light of your requirement. And, if you'd like a copy of our 28-page bulletin describing gas turbines, write to General Electric Company, Schenectady 5, N. Y., for GEA-5516, "Gas Turbine Power Plants."

GAS TURBINES

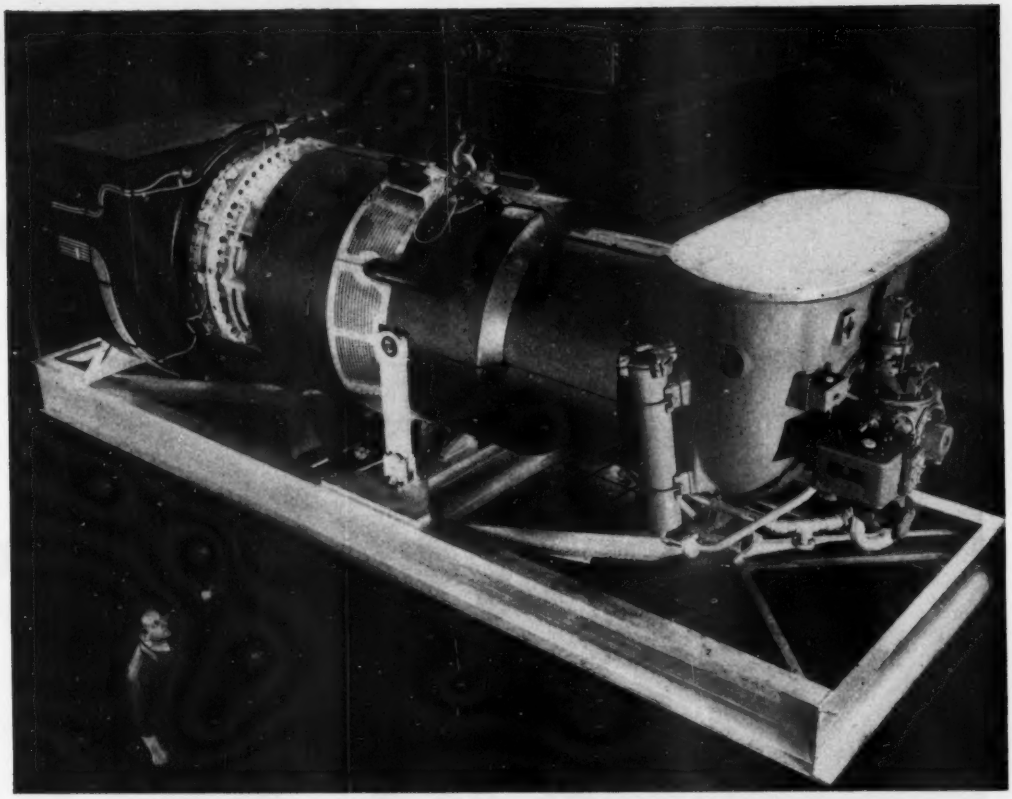


A COMPLETE POWER PLANT is yours with the compound-cycle gas turbine illustrated here. It is delivered with regenerator and intercooler and requires a minimum amount of cooling water.

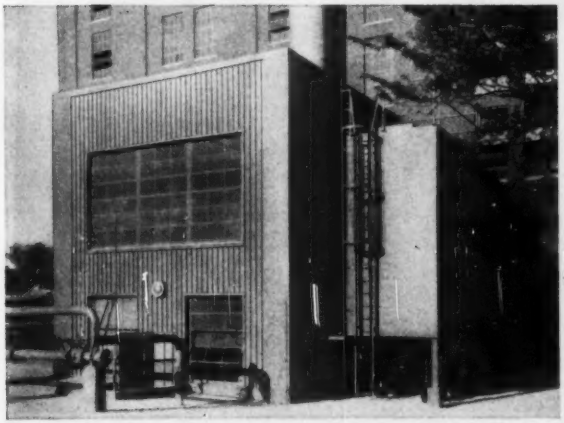
GENERAL ELECTRIC

255-4

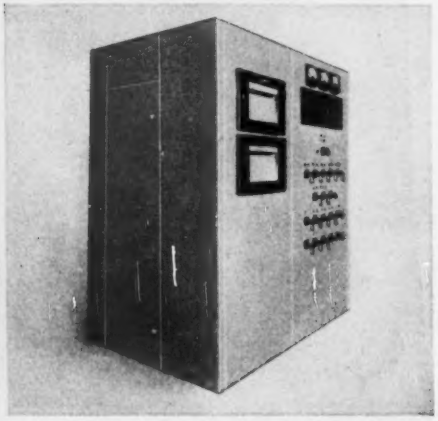
AT THE END OF THE LINE



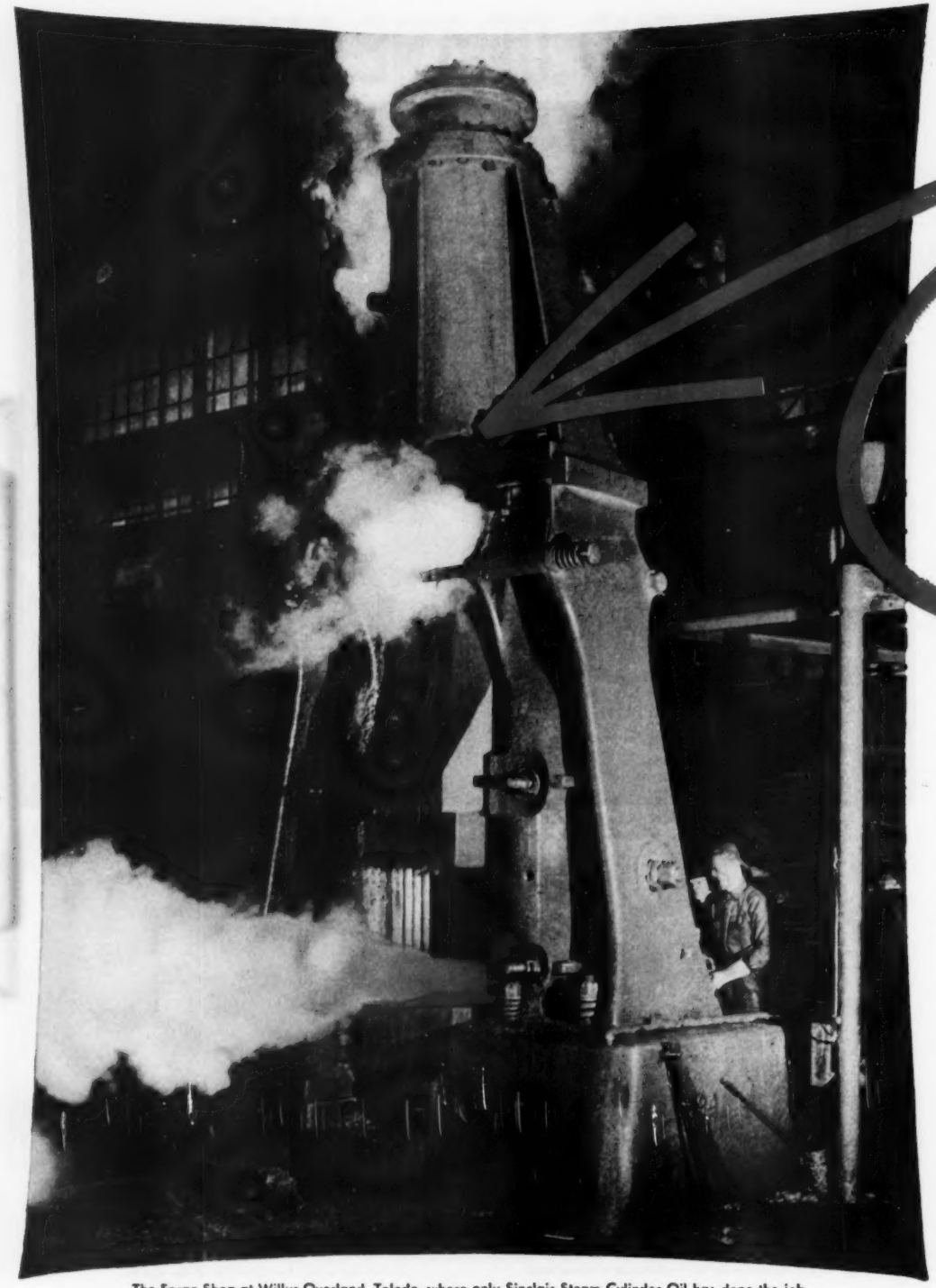
EASY INSTALLATION is possible because of the compact design and relative light weight of the gas turbine. The components of the simple-cycle unit can be easily handled for inspection and assembly purposes.



THE SIMPLE BUILDING AND FOUNDATION required for a gas turbine installation makes possible substantial savings in initial cost for end-of-the-line plants. In this building, the gas turbine rests on a reinforced concrete slab.



EASE OF OPERATION is a big factor in end-of-the-line plants. The control unit shown here contains all instrumentation and control equipment for operation of the turbine.



The Forge Shop at Willys-Overland, Toledo, where only Sinclair Steam Cylinder Oil has done the job.

"NO OTHER OIL has done this Job!"

reports Willys-Overland Forge

Mr. Wm. Paris, Vice President in Charge of Manufacturing at Willys-Overland Motors, Inc. says, "We have saved plenty of cylinders, packing, and down-time since shifting to Sinclair lubrication."

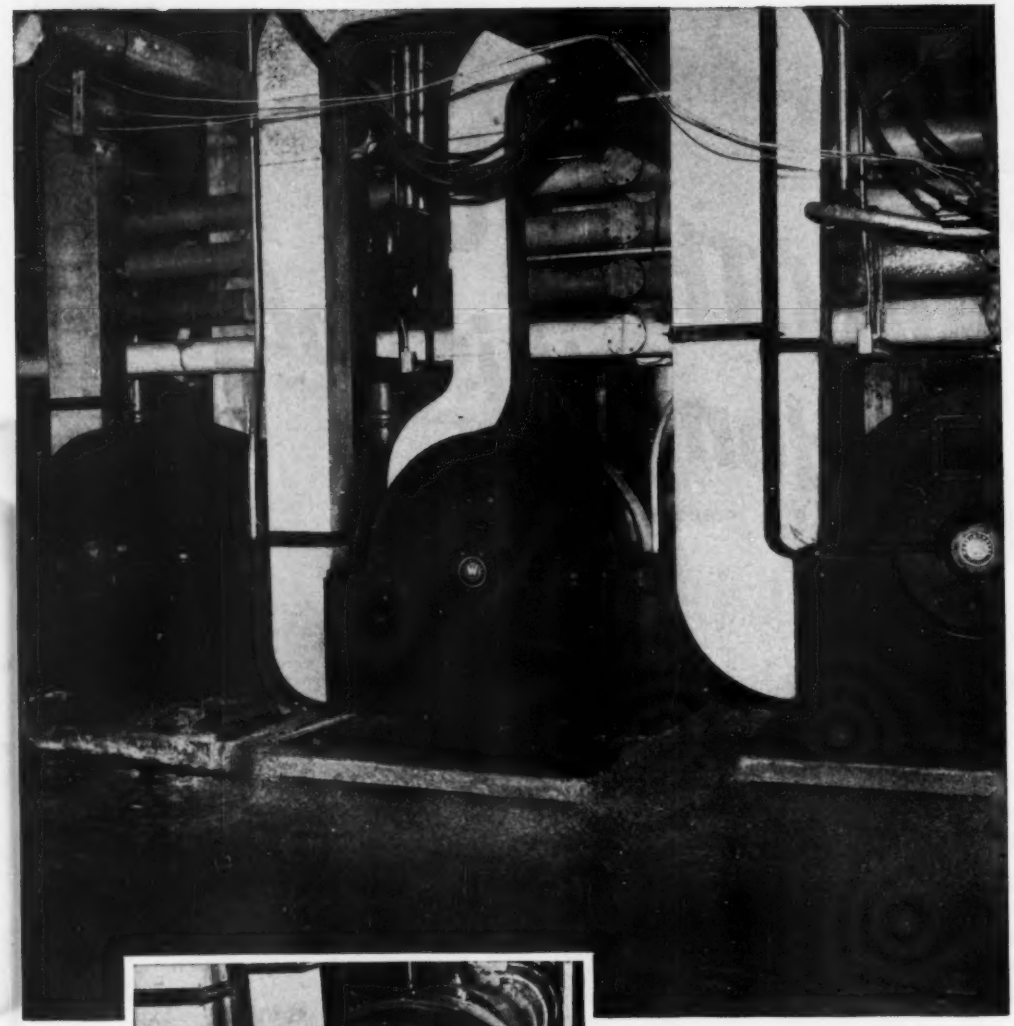
Rising production forced the mammoth Forge Shop at Willys-Overland to step up ram speed 30%. As the power was insufficient, the steam had to be raised to 400°F. by superheating. Then the lubrication problem started!

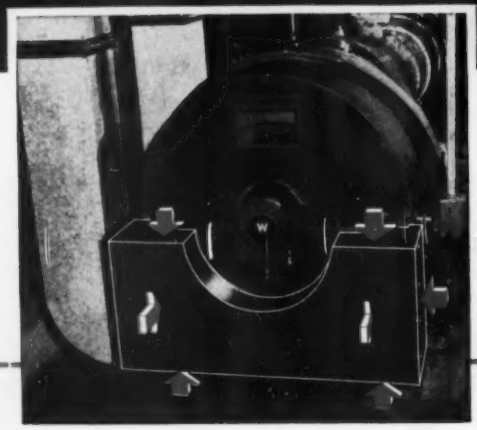
The hotter steam and faster ram speed quickly burned up packings, and cylinders became scored. Many lubricants were tried. All failed to halt the destruction... until the Forge tried Sinclair Valve Oil Light. Now it reports it hardly ever has a scored cylinder and no more lubrication headaches. The Forge does not believe it possible to get finer steam cylinder lubrication and emphatically concludes that, "No other oil has done this job!"

If you have a steam cylinder lubrication problem it can pay you to consult with Sinclair, for Sinclair makes a wide variety of Steam Cylinder Oils to handle every possible need. Get in touch with your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Ave., New York 20, N. Y.

SINCLAIR STEAM CYLINDER OILS

for every steam cylinder installation





The above is a typical forced-ventilated installation. These same ducts could have been brought into these motors from any angle as shown by the arrows on the inset at the left.

WHERE FORCED VENTILATION IS REQUIRED . . .

Westinghouse Air Inlet Brackets Offer Complete Flexibility of Installation

From the top, bottom, front or either side . . . ventilating ducts or pipes may be brought in from practically any angle to this forced-ventilated, large induction motor. It's the ventilation system and design of the air inlet brackets that make this possible.

Ventilating air is supplied to the motor from both ends through the two air inlet brackets. These brackets can be supplied with duct or pipe connections located on any of the exposed surfaces. Thus, many installation problems are eliminated and the motor can be positioned without regard to the space available for duct work.

The ventilating air is discharged from both sides of the motor through louvered openings. If desired, these openings can also be housed so that the exhausted air can be routed away through similar ducts or pipes.

Other important Westinghouse features that you will want to consider in selecting your next large induction motor are:

Bearing construction and end enclosures make bearing inspection, cleaning, servicing and replacement as easy as on a standard open motor.

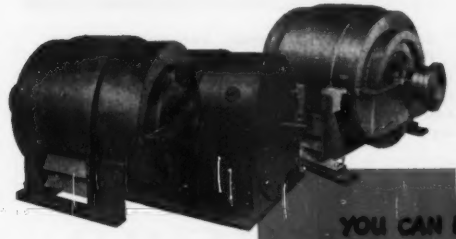
Welded steel construction to form a sturdy frame.

Insulation of great dielectric strength and high heat resistance for long life.

All-metal rotors are dynamically balanced for quiet, smooth operation.

Ask your Westinghouse representative about all the details of this improved large motor or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-10356

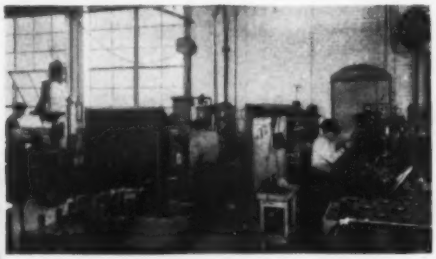


Also available are these three types of large induction motors. Open dripproof motors for general service. Outdoor motors for service in the open weather. Splashproof motors for protection against falling liquids or solid particles.

YOU CAN BE SURE . . . IF IT'S Westinghouse

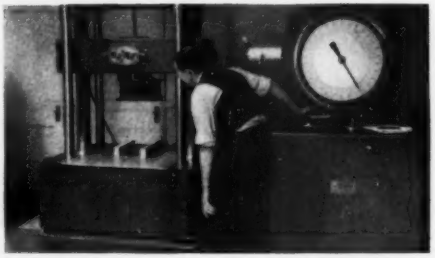
LARGE INDUCTION MOTORS

Why Grinnell is America's #1 Supplier of PIPE HANGERS *and* SUPPORTS



GRINNELL, ALONE, MANUFACTURES A FULL AND COMPLETE LINE OF HANGERS AND SUPPORTS

No other company, anywhere, makes a line as complete or varied. Grinnell produces hangers in thousands of combinations to support any piping.

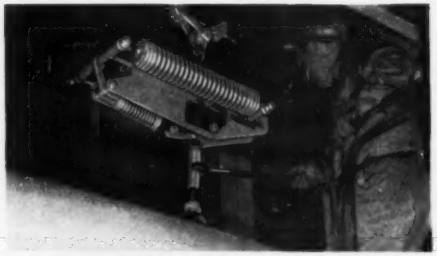


GRINNELL, ALONE, MAINTAINS AN EXPERIENCED LABORATORY STAFF OF TRAINED TECHNICIANS

In its modern, well-equipped laboratory, tests are constantly being made to discover better ways of solving old and new pipe suspension problems.

GRINNELL PROVIDES HIGHLY SKILLED ASSISTANCE AND ADVICE RIGHT FROM THE DESIGN STAGE

Grinnell's Pipe Suspension Department makes available specialized knowledge in the computation of hanger loads and the selection of the correct supports. No other company can match this service.



GRINNELL, ALONE, OFFERS EXPERIENCED FIELD ENGINEERING SERVICE ON THOSE "TOUGH" JOBS

Grinnell maintains an experienced staff of engineers in the field . . . ready to assist you "on the job" with any problems in the erection of pipe hangers and supports, no matter how difficult or complex.

WRITE FOR THIS FREE PIPE HANGER MANUAL

Here, between the covers of a single book, is everything you need to write hanger specifications. This book can be used both as a Grinnell Pipe Hanger Catalog and a comprehensive manual. It's available to you without cost . . . yours for the asking.

Pipe suspension presents a tremendously wide range of problems involving weight, stress, thermal movement, materials and specialized engineering. No one "goes into" the pipe hanger business overnight. Large manufacturing facilities, skilled technicians, and a lot of down-to-earth practical experience are needed.

Grinnell has become America's No. 1 supplier of pipe hangers and supports only because Grinnell has specialized in piping for one hundred years. Grinnell has developed a line of pipe hangers and supports for every piping requirement, from the simplest to the most complex. Grinnell, and Grinnell alone, can offer these advantages:—

- Complete "start-to-finish" production facilities — including research, design, manufacture, engineering and field service.
- Practical experience in every type of piping gained during the past 100 years.
- Coast to coast distribution — enabling "out of stock" purchases, anywhere.

It is important to remember that should some detail of piping arrangement make it necessary to deviate from hangers of standard design, Grinnell will design and manufacture hangers to meet the special requirements. Also, Grinnell is always ready to co-operate with engineers and architects in the preparation of pipe suspension specifications.

Call Grinnell for pipe hangers and supports.

Grinnell makes pipe hangers and supports for every installation . . . from a simple water pipe to high pressure, high temperature steam lines. All are scientifically designed, ruggedly built.

GRINNELL, ALONE, THROUGH ITS CONVENIENT WAREHOUSES CAN SUPPLY YOU "OUT OF STOCK"

No manufacturer of pipe hangers offers a distribution system as thorough or efficient. Grinnell warehouses are located in 30 principal cities . . . with jobbers in practically every city, coast to coast.

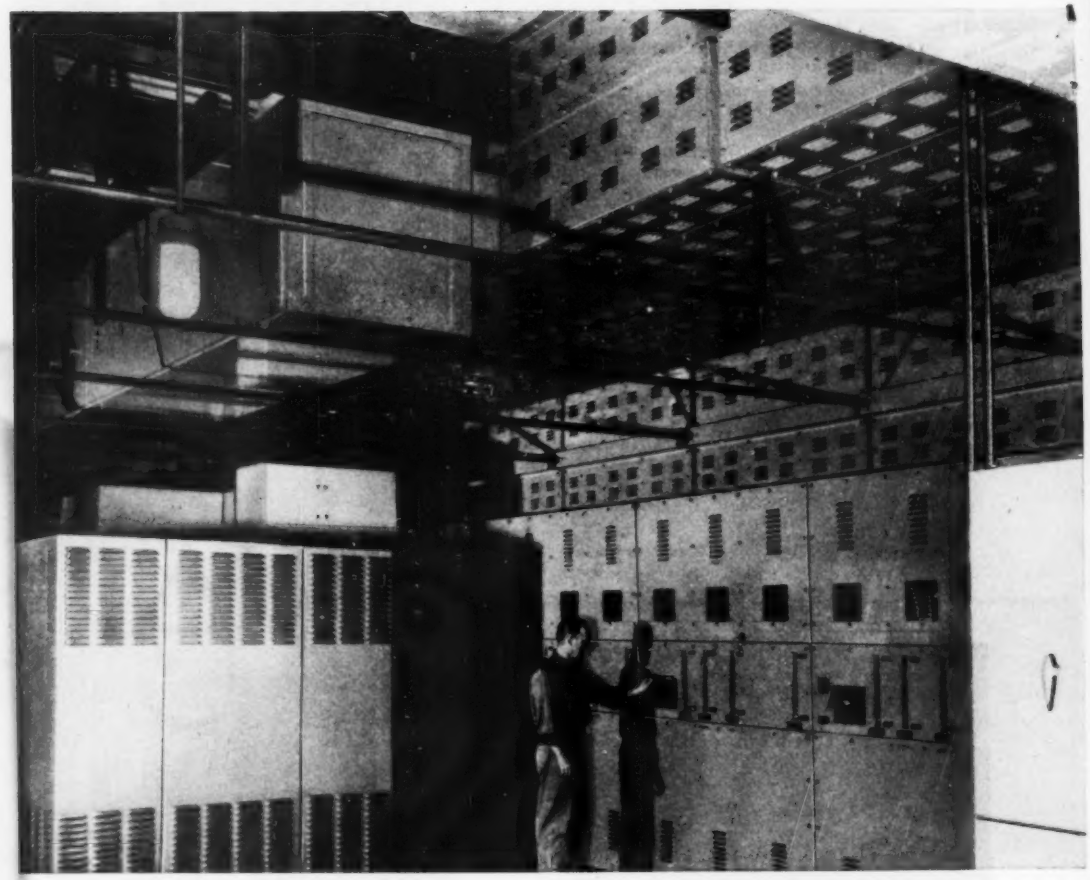
GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company Inc., Providence, Rhode Island • Sales Offices and Warehouses in Principal Cities

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco humidification and cooling systems

Switchgear for your entire station



COMPLETELY METAL-ENCLOSED COMPONENTS INSTALLED AS A UNIT. These units are part of over-all switchgear project. Attendant inspects cable entrance compartments. Note metal-enclosed bus overhead, potential transformers upper left, synchronizing reactors at lower left.

An outstanding example of

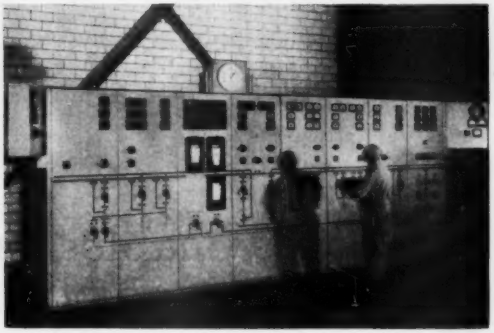
Project Planning

These General Electric, metal-enclosed equipments greatly simplify the planning of modern power stations. Installations may be made more compact. Complete enclosure in metal gives you greater safety and dependability.

Each of these metal-enclosed equipments is a completely co-ordinated unit—factory assembled and tested, shipped ready to install. Complete use of standardized G-E units permits an over-all co-ordination that may simplify your entire station design. For further information see your local G-E sales office or write to General Electric Company, Schenectady 5, New York.

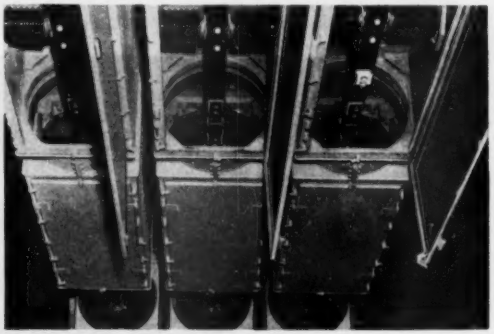
ordered and installed as one unit

METAL-CLAD EQUIPMENTS with Magne-blast circuit breakers for medium capacity circuits. Factory-assembled and completely co-ordinated, they include circuit breakers, buses, interconnections and interlocks—all in one compact package.



METAL-ENCLOSED DUPLEX SWITCHGEAR for centralized control and metering. These complete, factory-assembled units have control and indicating equipment on the front panels and recording, regulating and protective equipment on the rear.

METAL-ENCLOSED CABLE ENTRANCE COMPARTMENTS for the local power feeders. They include cable potheads and group-operated disconnect and grounding switches which permit easy isolation of the cable during maintenance.



METAL-ENCLOSED ISOLATED-PHASE BUS for all primary connections. Designed to withstand heavy-duty, high-capacity short-circuit stresses they are completely assembled and ready to install with other components.

METAL-ENCLOSED AIR-BLAST-CIRCUIT-BREAKER CUBICLES for main power circuits. Features included phase-segregation, mechanical interlocks, and silver contact surfaces. Available also with low-oil-content circuit breakers.

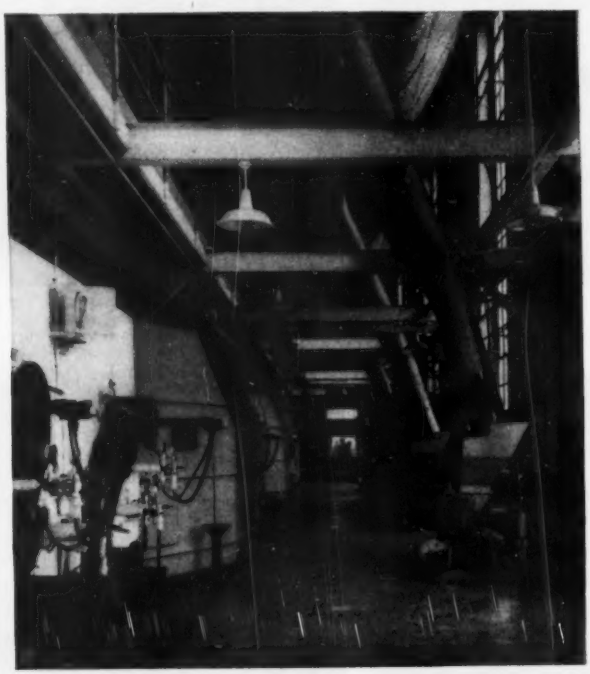
METAL-ENCLOSED REACTOR EQUIPMENTS factory-assembled with ventilated, grounded steel compartments—all ready to interconnect with metal-enclosed bus. Hinged doors provide easy accessibility for inspection and maintenance.

GENERAL ELECTRIC

855-27

THE C-E VERTICAL

"...enables us to handle load swings up to 100,000 lb per hr...



Looking down the firing aisle of Baldwin's fine modern steam plant containing three 160,000 lb per hr C-E Vertical-Unit Boilers; pressure, 300 psi; temperature, 450 F. The feeders for the C-E Raymond Bowl Mills, located on the floor below, are shown at the right. C-E combination coal-oil burners are seen in the left foreground.

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS. ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

UNIT BOILER...

...has reduced our coal consumption by 30,000 tons per year."

Mr. Michael J. Buckley, Superintendent of Power Plant of the Baldwin-Lima-Hamilton Corporation — Eddystone Division, in the January-February issue of *Meters and Controls* tells of his experience with the C-E Vertical-Unit Boiler:

"Formerly we had three boiler rooms containing two sets of four boilers and one set of eight boilers respectively. These units were 40 years old and could not be used to their full rated capacity. In 1945 the entirely new power plant was erected, containing three 160,000 pounds per hour 300 psi Combustion Engineering–Superheater boilers, total steam temperature 450 F.

"The new steam generating units have given us greater and more flexible capacity (handling load swings up to 100,000 lb per hr), has reduced our coal consumption 30,000 tons per year, has enabled us to cut our power plant labor force by forty-two men for the winter operation and has decreased our maintenance expense.

"We planned the installation for using either pulverized coal or oil, and have found that provision to be an excellent one. We can change from one fuel to the other quickly, enabling us to use whichever fuel is cheaper."

C-E is frank to acknowledge — and glad to credit — the exceptionally careful and intelligent operation of these VU Boilers by the Baldwin operating personnel. And this combination of correctly designed equipment, expertly operated, is paying handsome dividends. Credit, too, should be given to the H. M. Wilson Co., designers of this plant.

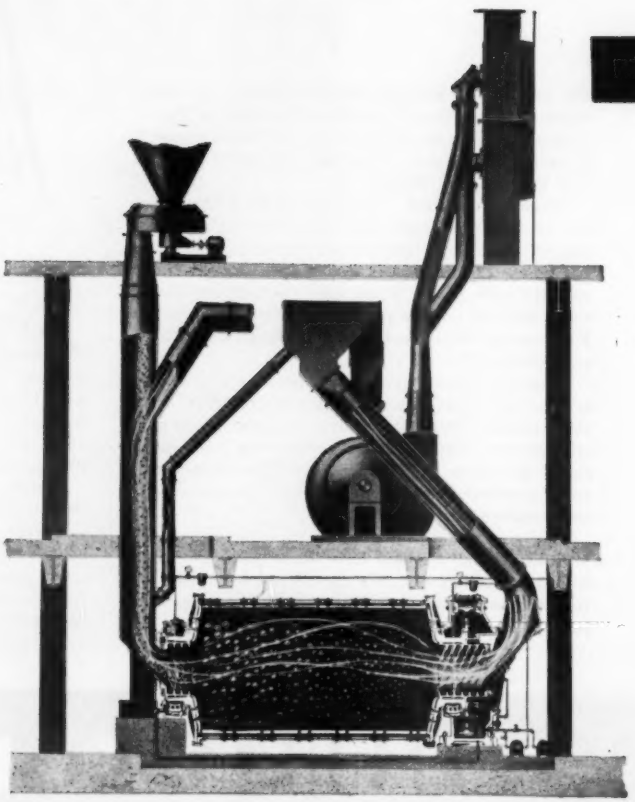
For hundreds of plants throughout the United States, representing virtually every type of industry, C-E Vertical-Unit Boilers have proved to be the one best answer to operating economy and efficiency. How about your plant? Our engineers will be glad to work with yours, towards lower steam costs, whatever your requirements may be. B-512

— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

KVS Engineered

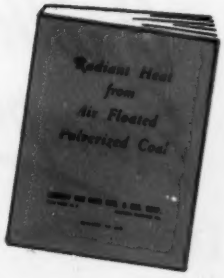


PULVERIZATION
prepares Superfine Fuel for *Instant Response to Combustion Controls*

Air sweeping . . . by the direct inlet-to-outlet current of controlled quantity air . . . delivers air-coal mixture to the burners fast. From mill reserves of coal ground to pass 85% through 200 mesh, full capacity is available to meet heavy steam demand. Fluctuating loads are met easily. No coal is lost due to banking of fires at low load.

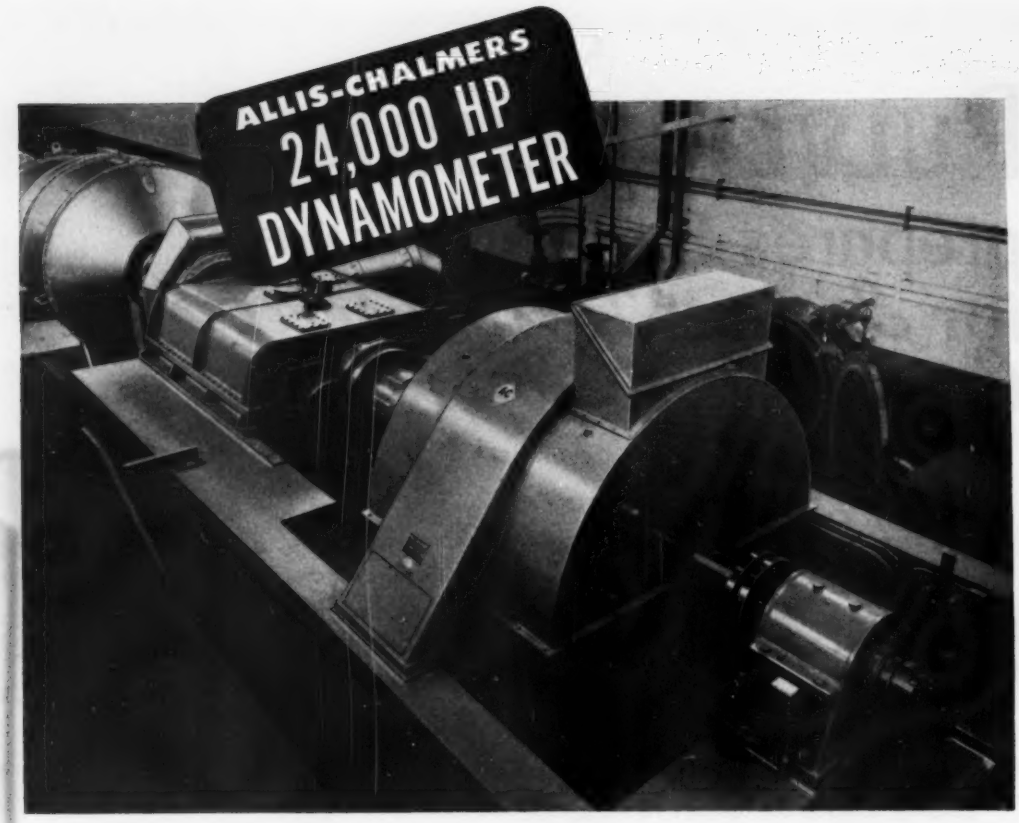
Coal unsuitable for other types of firing can be pulverized to an instantly combustible fuel in KVS Air Swept Ball Tube Mills. Coal, pulverized in air to KVS-recommended fineness, burns like a gas.

Coal containing from 5% to 15% moisture is direct fired. No magnetic separator is used. 99% availability . . . and better . . . contributes materially to low operating cost.



Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION
2 PARK AVENUE • NEW YORK 16, N. Y.
FACTORIES: DANVILLE, PA.
CANADA • ENGLAND • FRANCE • AUSTRALIA



Another Example of Allis-Chalmers Engineering

DESIGNING AND BUILDING this special power-delivering dynamometer required engineering skill available only to a company such as Allis-Chalmers with its century of engineering experience.

Arranged for direct measurement of torque, the dynamometer has an accuracy of ½% of the rated torque. Its overall speed range is 1210 to 15,072 rpm. And the 24,000 hp synchronous motor and its speed-increasing gear are supported by a special hydrostatically mounted base. Although the assembly weighs 130,000 pounds, it is so well balanced and cradled that it can be moved by the pressure of a man's finger.

The dynamometer was built for the Pratt & Whitney Aircraft Division of United Aircraft Corporation for testing turbo-jet engines. Allis-Chalmers also supplied the torque measuring equipment, metal-enclosed bus duct and switchgear.

Whether you need special or standard equipment—for power generation, distribution or utilization — you can benefit from this engineering experience by calling your nearby A-C representative. Allis-Chalmers, Milwaukee 1, Wis.

A-3501

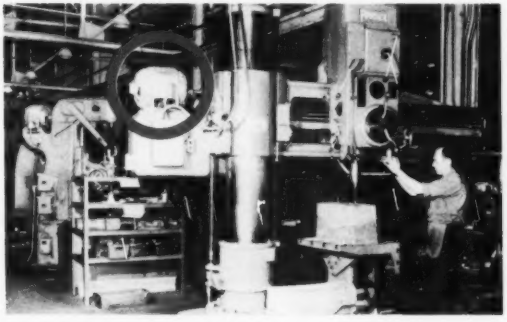
ALLIS-CHALMERS A-C ALLIS-CHALMERS

"We have three shifts in operation," says Julius J. Domonkos, Vice-President in Charge of Manufacturing, Bell Aircraft Corporation. "That's full production on a 24-hour day basis. For the past 10 years we've been depending on Tri-Clad motors to carry the load. We've never regretted putting our confidence in this fine motor!"

G-E Tri-Clad Motors drive the machines that are instrumental in producing helicopters, guided missiles, rocket motors, research aircraft, and jet aircraft engine nacelles for our rapidly expanding armed forces. At Bell Aircraft Corporation, G-E Tri-Clads are known as a thoroughly dependable motor —tough on the outside . . . on the inside . . . at the bearings.

BELL AIRCRAFT CORPORATION:

"We've been depending on Tri-Clad* Motors for Ten Years . . ."



This Tri-Clad driven radial drill takes care of most of the large dies for the entire Bell plant. Big dies and bolster plates are drilled and tapped on this machine, a critical part of the Bell operation. Despite continuous use, plant personnel can't remember a single interruption due to Tri-Clad failure!

*Reg. trademark of General Electric Co.

FASTEST BOMBER IN THE WORLD! Jet engine nacelles for the 600-plus miles-per-hour B-47 are being produced at a record-breaking clip in the Bell plant at Buffalo, N. Y. The "Stratojets" represent a major advance in bombardment aircraft.

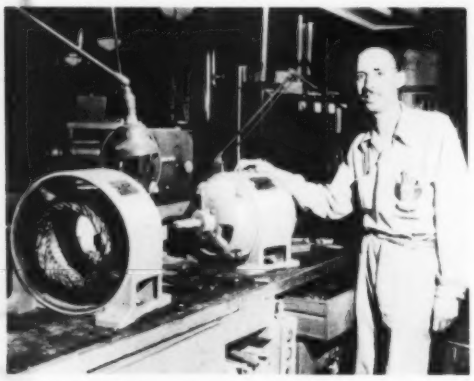
GENERAL ELECTRIC

TRI CLAD MOTORS

REG. U.S. PAT. OFF.

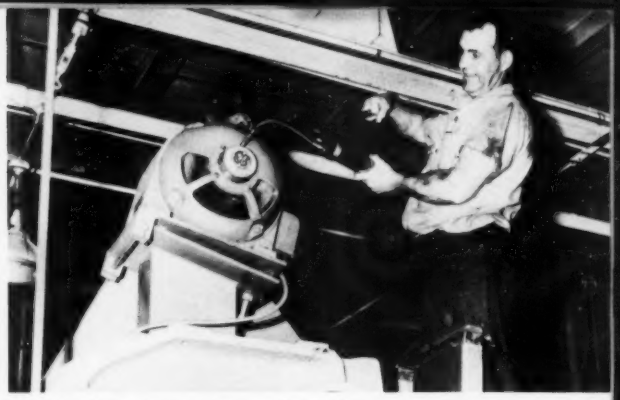
Help keep Bell Aircraft production up!

Marvin Limburg (left), Foreman of Bell's Tool and Die Shop, comments, "I don't believe we've ever lost machine time due to breakdown of Tri-Clad motors. And our jig-borers, for example *have been operating around the clock for the last 8 to 10 years!*"

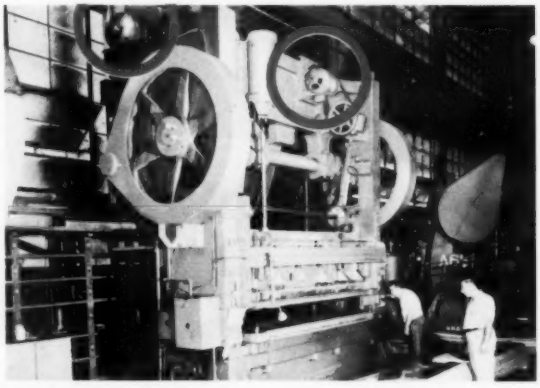


"It's the easiest motor we have to maintain" according to Maxwell Anderson, Crew Chief of Bell's motor repairmen. "There's more working room inside and more room in the slots. It's become a byword with us that if you give a Tri-Clad motor ordinary care you'll never have to worry about maintenance."

TIMELY READING—With every electric motor needed on the line, you'll want a copy of the G-E manual on "How to Maintain Motors and Generators." It's free; just ask for bulletin GET-1202. *Sect. 752-10, General Electric Company, Schenectady 5, N. Y.*



Greasing isn't necessary on a Tri-Clad motor in normal service, but it's always reassuring to know that you *can* lubricate if you so desire, without time-consuming disassembly. The photo shows how easy it is: remove relief plug, attach the grease gun nozzle, squirt—the job is finished.



This huge punch press is an important tool maker. Anton Geiser (right), assistant punch press foreman, says: "I can't recall a single shutdown of this section due to motor failure." Almost all motors in this department are Tri-Clad. This is another Bell Department which has been operating around the clock; cannot afford to lose time because of motor breakdown.

NEW! A Helpful Training Course on Motors!

Everyone concerned with technical training problems will want this new G-E Motor Selection and Application Course. Consists of 9 short, easily understood lessons. Complete kit —slide films, review booklets and instructor's manual— $100.00. Call or write your nearest G-E sales office.

Look at the Scope of this Course

1. Fundamentals of Motors
2. Types of Motors
2. Fundamentals of Selection
4. A-C Induction Motors
5. Single-phase Motors
6. D-C Motors
7. Synchronous Motors
8. Adjustable-speed Drives
9. Gear Motors

GENERAL ELECTRIC

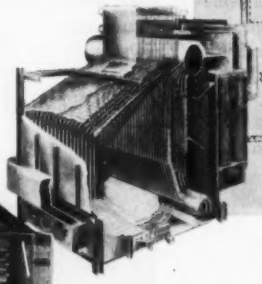
Another REPEAT for Springfield!

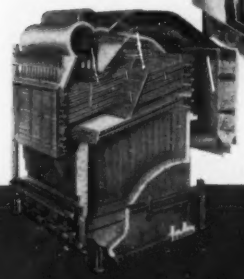
100,000 lb. unit for well-known midwestern maker of automobile parts

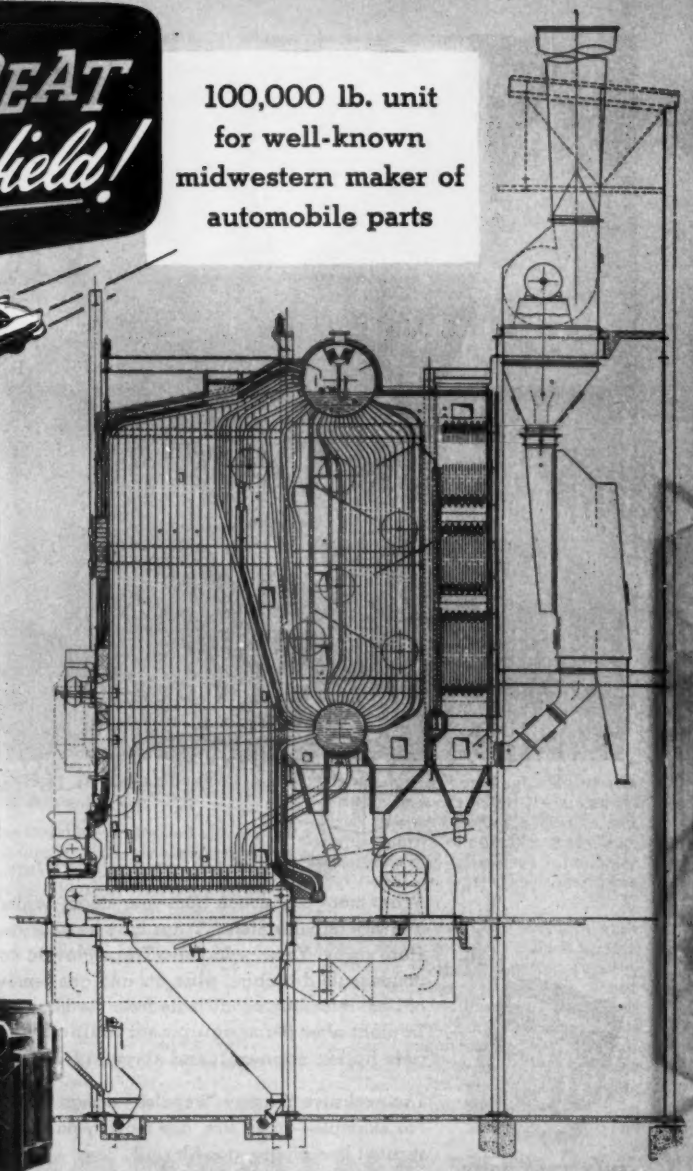
■ Users like Springfield Steam Generating Units! Less than a year after installation of a new 80,000 lb. Springfield unit, one of America's leading manufacturers of electrical parts for automobiles has "repeated" with an additional 80,000 lb. unit and a 100,000 lb. unit which are similar in design to the original 80,000 lb. unit.

Springfield's experience in building modern steam generating units is paying dividends for many industrial plants today. In Springfield designs, users get values that go beyond specifications. For Steam Generating Units that "are built to stay modern longer", check with Springfield — ANY SIZE ... ANY PRESSURE ... ANY TEMPERATURE ... AND FOR ANY FUEL! We will be glad to submit a proposal covering your requirements.

Check with Your Consulting Engineer on Modernization and New Plant Projects

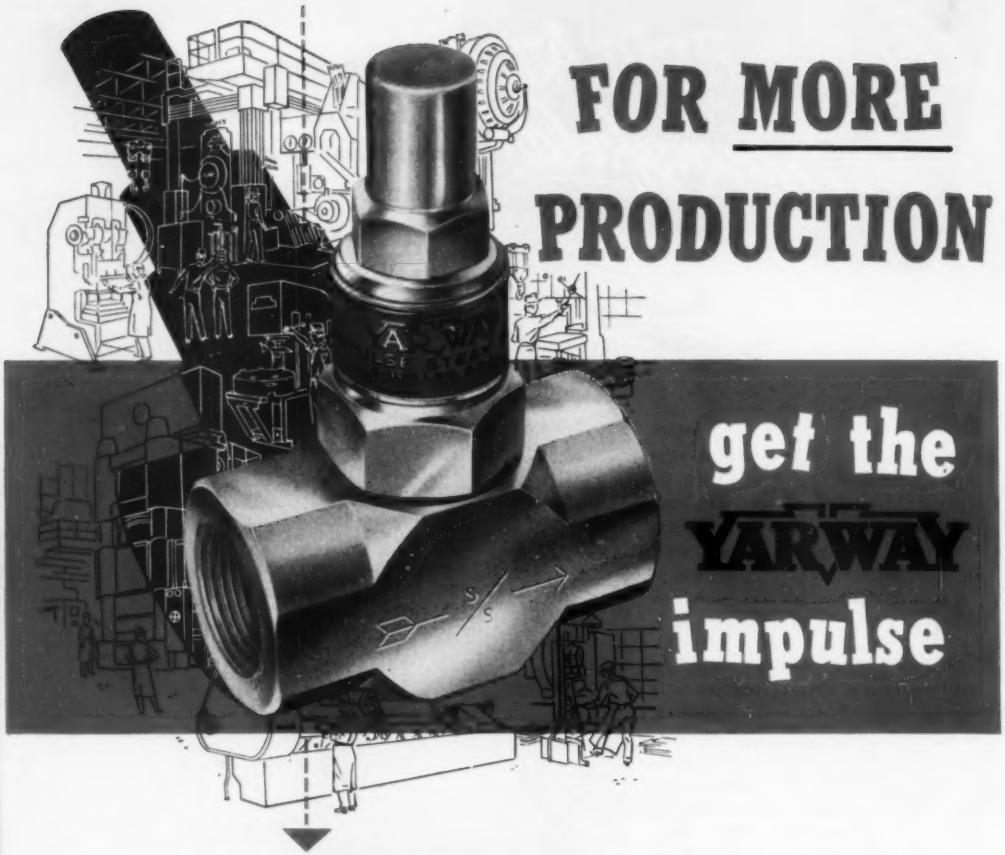






This 2-drum Springfield Steam Generator is designed for 225 psig and operates at 150 psig. The design features a completely water cooled furnace, economizer, forced and induced draft fans, and dust collector. Firing is by traveling grate spreader stoker.

SPRINGFIELD BOILER CO.



FOR MORE PRODUCTION

get the YARWAY impulse

Want more production from your steam-heated equipment? Yarway Impulse Steam Traps may be your answer! Here's why. Yarway Impulse Traps provide constant and complete condensate drainage, **plus** air and gas removal, **plus** velocity scrubbing of heat-retarding condensate from the heat transfer surfaces. In plant after plant, **equipment drained with Yarways gets hotter, sooner . . . and stays hot!**

The exclusive Yarway "impulse" design has other advantages. For example—small size, one moving part, straight line piping, good for all pressures, low cost and low maintenance.

Nearly 750,000 Yarways have already been installed in thousands of plants in nearly every industry. Get Yarways from your nearby industrial distributor . . . 216 stock and sell Yarways.

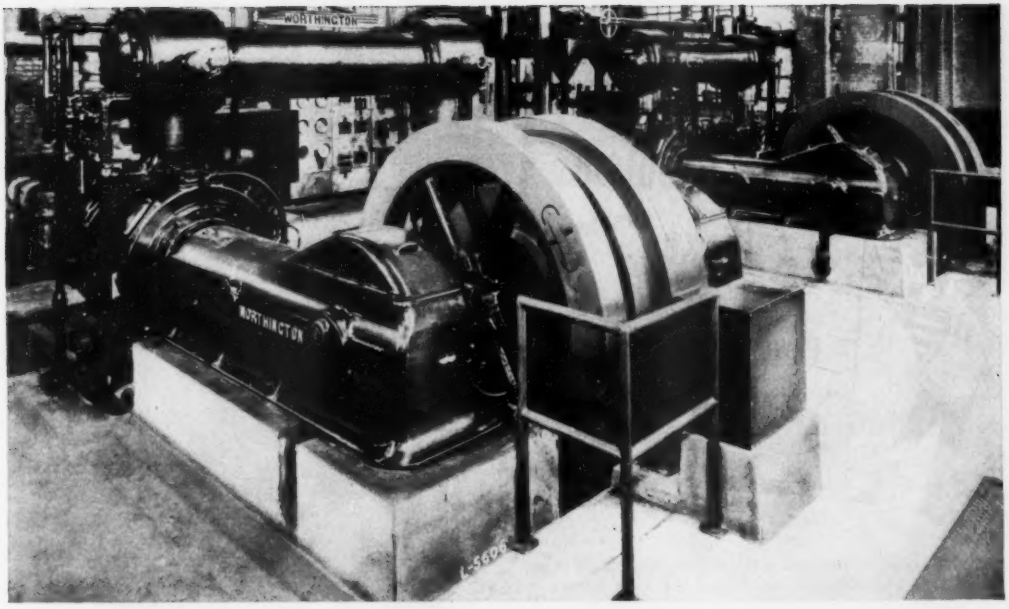
FREE TRAP BOOK

It's full of valuable steam trap data. Write for your free copy of this new 24-page book today.

YARWAY

the steam trap designed with more production in mind

YARNALL-WARING COMPANY ● 100 MERMAID AVENUE, PHILADELPHIA 18, PA.



Link-Belt "Hooks Up" with Worthington Air

You can't find a compressed air need that Worthington can't fill.

This installation pictured above is a Worthington DC2 air compressor in Link-Belt Company's Pershing Road plant in Chicago. And that picture could be duplicated all over America where engineering-wise plants insist upon dependable, trouble-free, low-cost air.

One reason is—*only* Worthington makes air compressors with the Feather* Valve. Any other valve is complicated beside this Worthington exclusive. Feather* Valve is the simplest, lightest, most efficient ever made.

Then there's Worthington automatic variable capacity control—acknowledged the most accurate, flexible and simple control obtainable. And Worthington's high-efficiency intercooler that needs less water, less power, less attention.

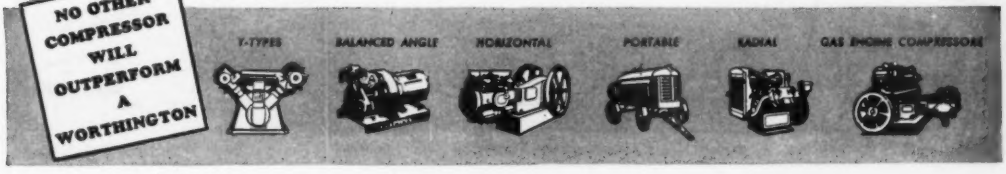
Build around these features with sturdy construction . . . back up the machinery with Worthington application engineering—and you have plenty of reasons for deciding *there's more worth in Worthington.* Worthington makes all auxiliary equipment, too. Write for bulletin L675 B-1B to Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.

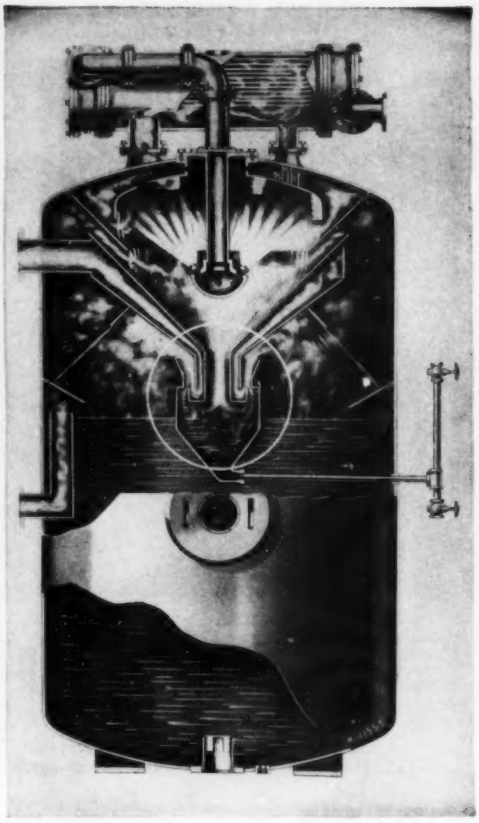
WORTHINGTON

*Reg. U. S. Pat. Off.

K1.9

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON





Hard scale, formed on the trays of deaerating evaporator preheaters, is no longer the big problem it used to be.

In a large central station (name on request), the preheaters had to be cleaned every three weeks, and the units were completely shut down at that time from eight to ten hours.

Then Worthington steam-jet deaerators were installed—with a "blowdown" head designed by Worthington engineers. This special head allows the operator to remove harmful deposits at regular intervals *while the unit continues in service*. It also provides for simple and speedy acid cleaning of critical parts, when necessary, without even opening an access door or removing any parts from the unit.

Compare The "Time-Outs"

The Worthington unit, given a short blowdown once each shift, stays in continuous operation with maximum deaeration for periods of at least 8 months. When the acid treatment is given at the end of that period, the job is finished in under three hours.

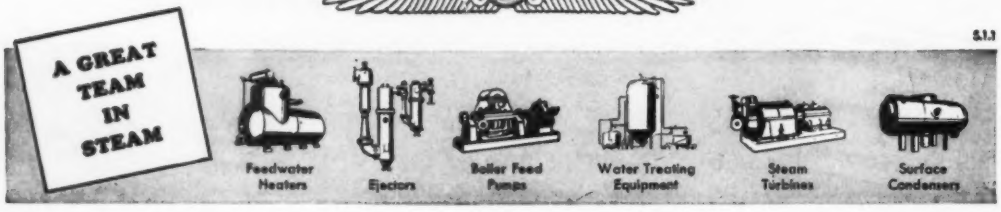
Compare this with the former record. *Then*—8 to 10 hours outage every three weeks and labor by a *crew* of men. Now—with Worthington's blowdown head—operation uninterrupted during regular short blowdown, with a shutdown for acid cleaning only once in almost a year, requiring only one man and three hours!

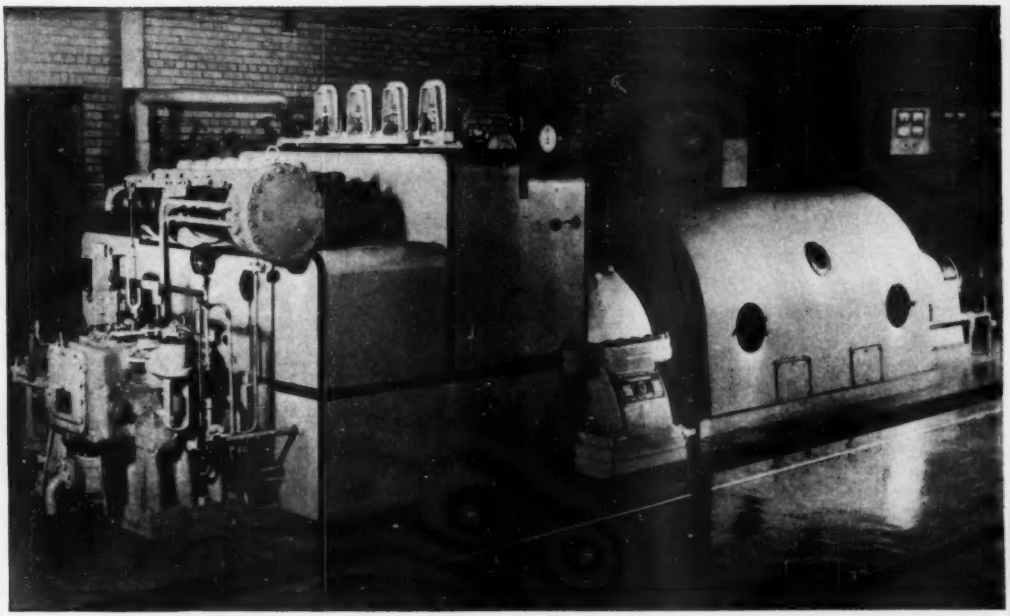
Worthington Makes Deaerating Equipment News

Developments like this, applicable to any deaerators operating under conditions of scaling, are typical of Worthington's engineering firsts in water treating and deaerating equipment.

Worthington manufactures all of the equipment needed in a complete water treating installation. For further information on why *there's more worth in Worthington*, address Worthington Pump and Machinery Corporation, Steam Power Div., Harrison, N.J.

WORTHINGTON





Story of an Economy Drive

How the Worthington Steam Turbine Pays Dividends for the City of Litchfield

What happened at Litchfield, Minnesota, is a clue to a most economical power plant operation.

Originally, the Litchfield municipal power plant consisted of low-pressure boilers, a steam engine and a small turbine-generator unit. The exhaust steam is sold for municipal heating.

Next—a Diesel engine-driven generator was installed. The load grew, and finally, after a careful survey, it was decided to install a 3000-kw Worthington turbine generator and automatically extract steam for heating purposes.

Worthington builds steam turbines in all types and sizes—and turbine-generator sets up to 10,000-kw. For proof *there's more worth in Worthington*, call our nearest office or write to Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, New York.

WORTHINGTON

STEAM TURBINE GENERATORS

T.J.9

WITH NEW ILLUMINATOR ON YARWAY FLAT GLASS GAGE . . .

BOILER WATER LEVEL Shines

It's light! It's bright! It's right! You see instantly the accurate boiler water level in your Yarway Flat Glass Gage because *the meniscus at water level stands out like a brilliant star* . . . thanks to the new Yarway Type "M" Illuminator.

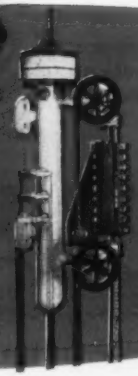
The Type "M" Illuminator is specially-designed to give maximum brilliance to Yarway flat glass inserts, and to spot the water level over its entire traverse. The superior penetration of its blue-white light cuts through extraneous light, dust particles in the air, and deposits on the gage glasses. Effective over longer distances.

New or already-installed Yarway Flat Glass Gages may be equipped with the Illuminator. Yarway Illuminators may be installed in pairs on four-glass gages.

Get in touch with your nearest Yarway office for further details on this latest Flat Glass Gage development, or write direct to . . .

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

A COMPLETE YARWAY WATER LEVEL SYSTEM



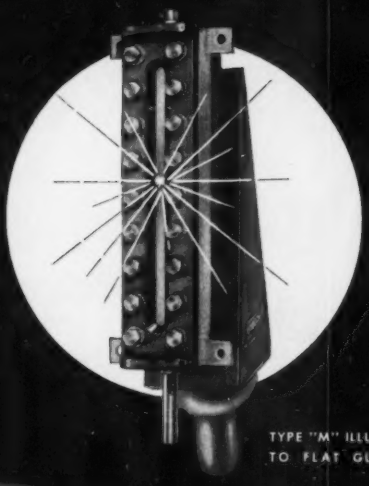
AT THE BOILER DRUM (Left) Yarway Floatless Hi-Lo Alarm Water Column with Vertical Pressure-Sealed Flat Glass Gages. Equipped with Type "M" Illuminator. See Bulletin WG-1812.

ON THE INSTRUMENT PANEL (Left) Yarway Remote Liquid Level indicator, operated directly by the boiler water itself. Indicating mechanism is never under pressure—no stuffing boxes. See Bulletin WG-1822.

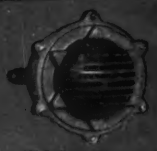
(Right) Yarway Hi-Lo Graph Recorder provides not only instant indication but also 24-hour recording of boiler water levels. See Bulletin WG-1830.

YARWAY STEAM

like a Star



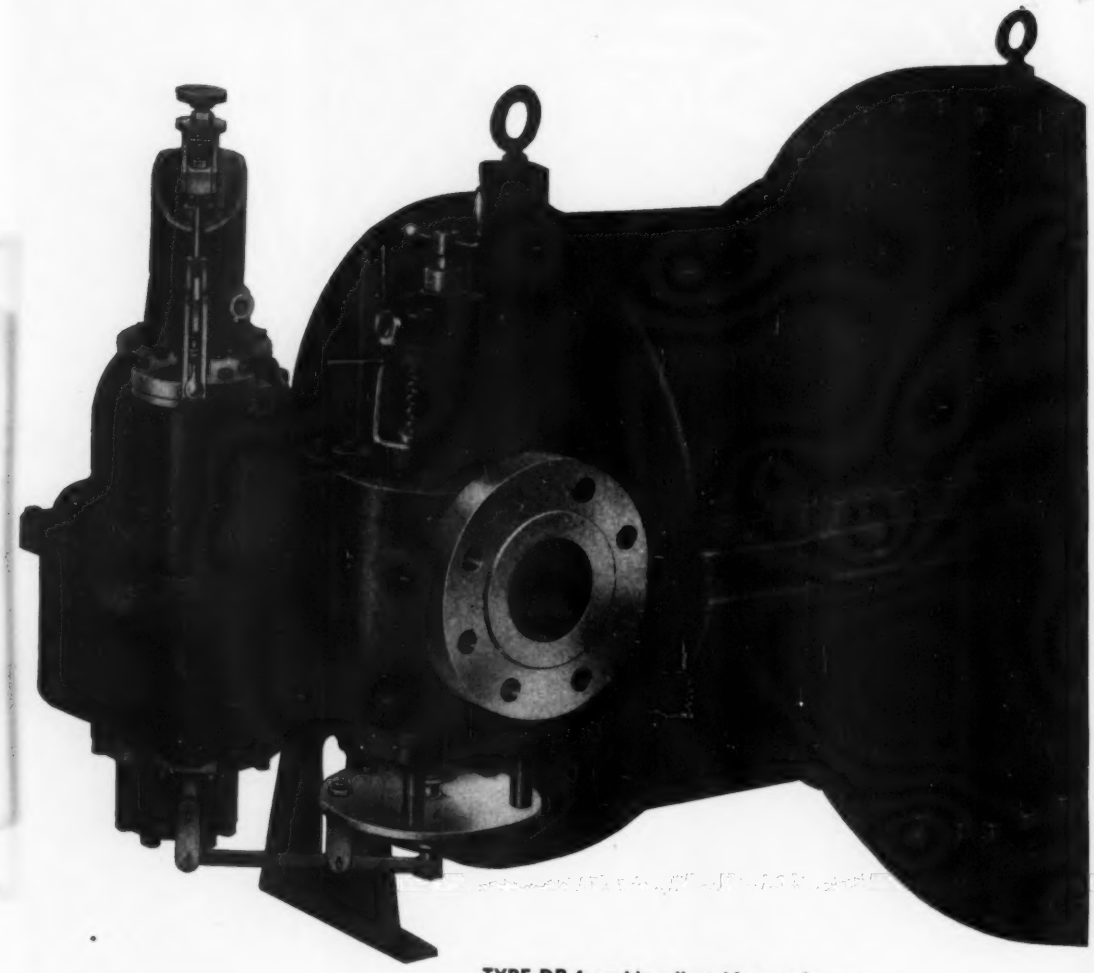
TYPE "M" ILLUMINATOR ATTACHED TO FLAT GLASS GAGE INSERT



IN THE PLANT
Yarway Remote Hi-Lo Alarm Signals—lights or horns. Operated by Control Unit available with Remote Liquid Level Indicator or Recorder. See Bulletin WG-1822.

PLANT EQUIPMENT

GENERAL ELECTRIC ANNOUNCES New



TYPE DR for wide adjustable-speed range

Multi-Stage Turbines

Available in Four Designs—200 to 5000 hp

Now in production! General Electric's completely new, multi-stage turbine drives . . . designed to give you maximum mechanical power for every fuel dollar . . . available to meet any mechanical drive application where efficiency and reliability are "musts."

FOUR NEW TYPES—The DP, DR, DRV, DRVX—incorporate the newest ideas in improved turbine design. Four different governing systems give you a wide selection of performance ratings for either condensing, noncondensing or automatic extraction applications.

NEW FEATURES that spell increased economy and reliability are built into General Electric's new multi-stage turbines. A completely new sectional valve gear, for instance, gives you greater efficiency for part load operation. Refinements in governing, lubrication and steam chest design make these the finest mechanical-drive turbines General Electric has ever produced.

A NEW TECHNIQUE of manufacturing from standard, interchangeable patterns promises you savings in initial investment and shortened delivery time. You get a custom turbine, designed for your job, built from standard parts.

Get the full particulars on these brand new multi-stage turbine drives. Write for your copy of our new bulletin, GEA-5580, "G-E Multi-Stage Turbine Drives." Section 252-52, General Electric, Schenectady 5, N.Y.

252-52

GENERAL ELECTRIC

COMBUSTION CONTROL

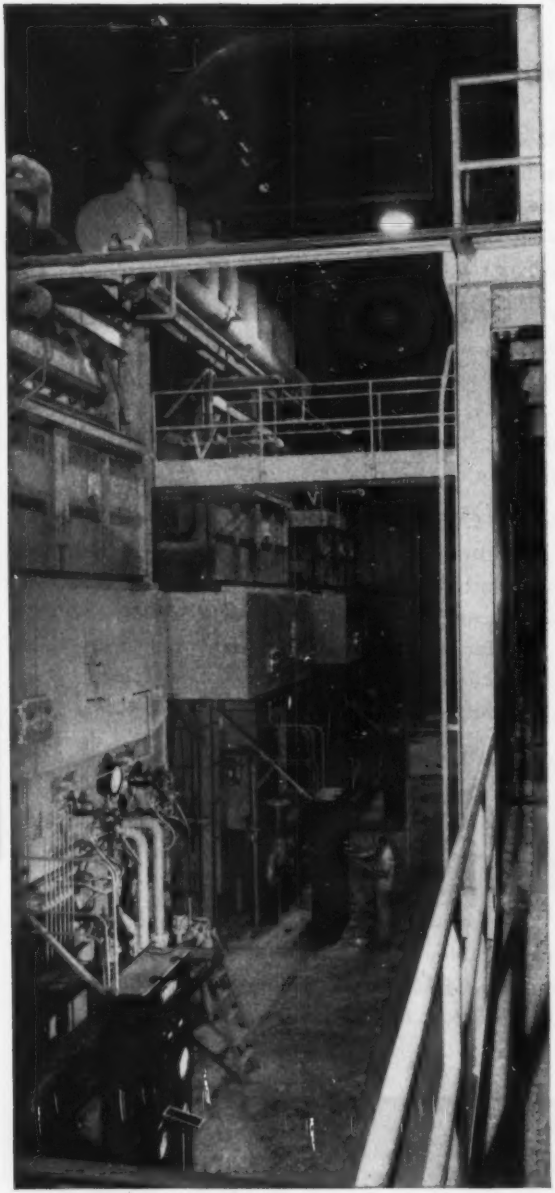
FOR
ALL SIZES OF BOILERS
ALL TYPES OF FIRING
ALL LOAD CONDITIONS

An automatic combustion control system, as designed and built by Republic, will enable you to operate your boiler (or boilers) over a long period at test efficiencies regardless of variations in fuel, load and other operating factors.

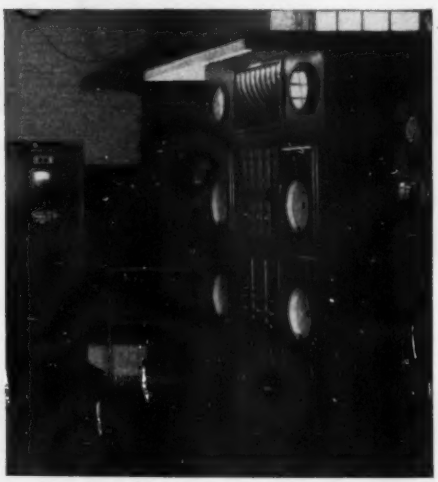
Republic combustion control is a unified system controlling simultaneously, in measured quantities and in correct proportions, the fuel and air input to the boiler.

It automatically increases or decreases the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency.

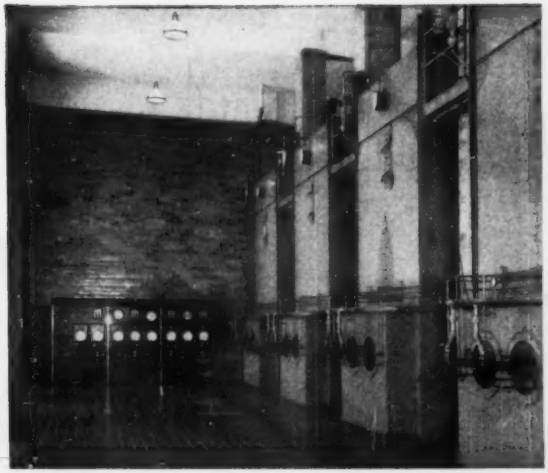
Republic automatic combustion control systems, either pneumatic or hydraulic, are available for all sizes of boilers, all types of fuel firing, and load conditions and any arrangement of draft equipment. They are completely described in Data Book No. S-21—write for your copy.



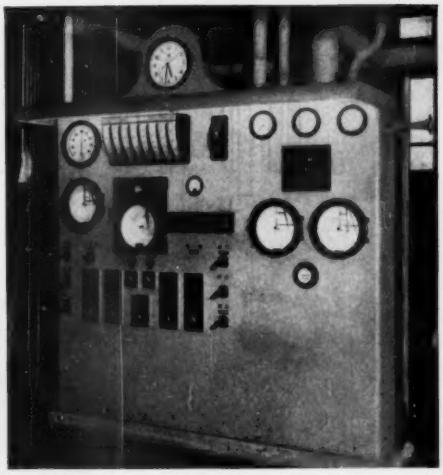
GAS FIRED—In this modern industrial plant steam is generated at the rate of 400,000 lbs. per hr. by four gas fired boilers operated by a Republic automatic combustion control system.



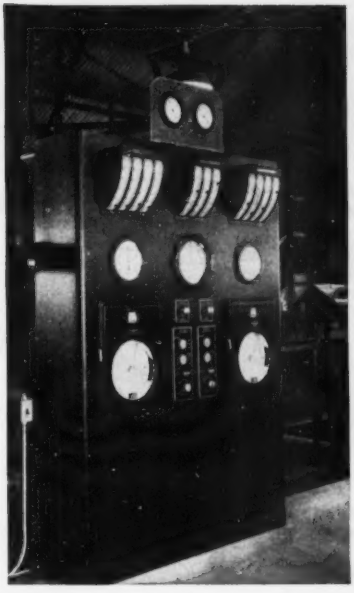
STOKER FIRED—The Republic instrument and combustion control panel for an 80,000 lbs. per hr., stoker fired boiler in a municipal power plant.



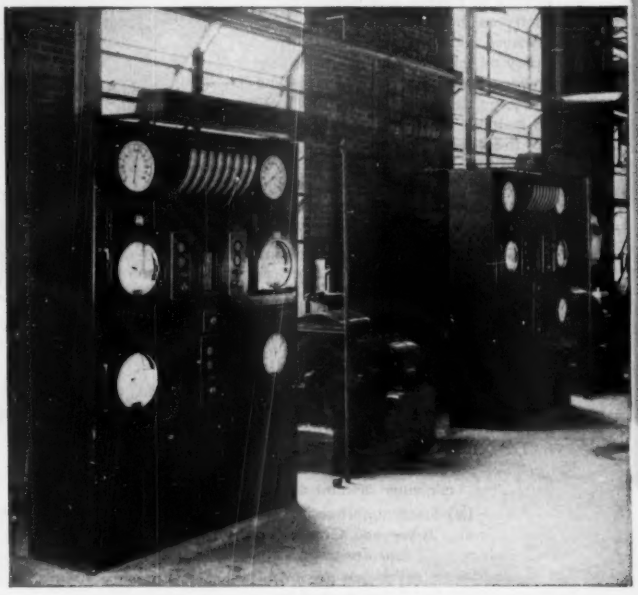
OIL AND GAS FIRED—In this model boiler room of a large institution the four combination oil and gas fired boilers are operated by a Republic automatic combustion control system.



STOKER FIRED—The Republic combustion control and instrument panel for the automatic operation of a 45,000 lbs. per hr. stoker fired boiler.



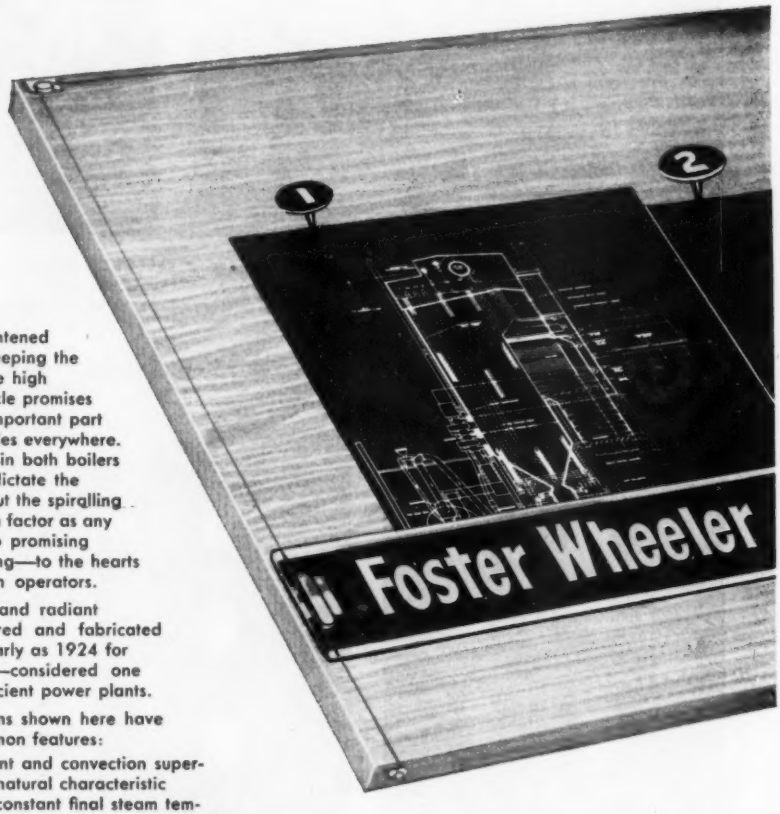
MIXED GAS—Republic instrument and control panel installed in a natural gasoline plant to automatically control two 50,000 lbs. per hr. boilers burning mixed gas.



STOKER FIRED—A typical Republic combustion control installation in the boiler room of a mid-western university for the automatic operation of two 25,000 lbs. per hr. stoker fired boilers. All boiler instruments and manual controls are centralized on the two panels pictured above.

REPUBLIC FLOW METERS CO.
2240 Diversey Parkway, Chicago 47, Illinois

. . . up to the largest



A new wave of enlightened interest in Reheat is sweeping the country as the role of the high pressure, high steam cycle promises to play an increasingly important part in power-generating facilities everywhere. Today, design developments in both boilers and turbines frequently dictate the use of the Reheat Cycle. But the spiralling cost of fuels is as much a factor as any in endearing this tool—so promising from its very beginning—to the hearts of steam-electric station operators.

Radiant superheaters and radiant reheaters were engineered and fabricated by Foster Wheeler as early as 1924 for one midwest station—considered one of the country's most efficient power plants.

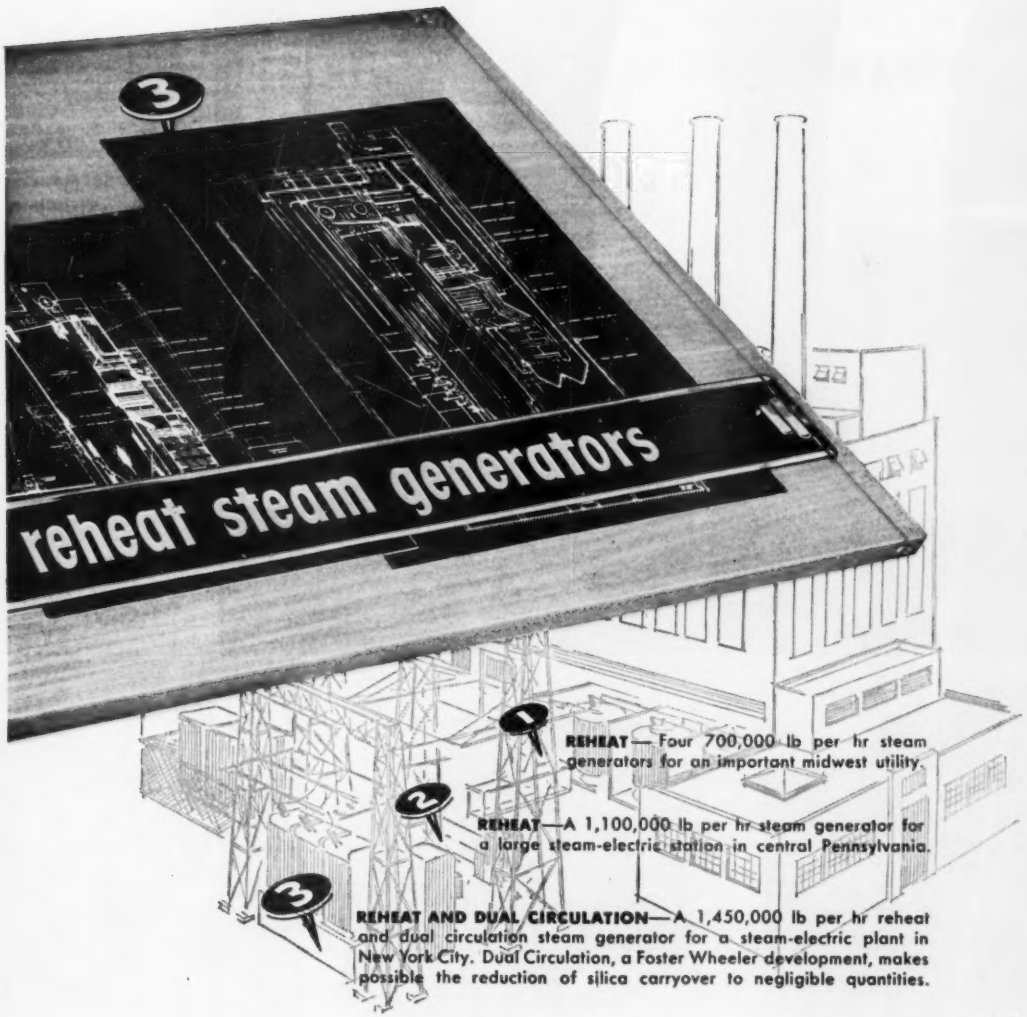
The Foster Wheeler designs shown here have the following common features:

(a) Combination radiant and convection superheaters have a natural characteristic maintaining a constant final steam temperature over a wide load range with a minimum amount of control equipment.

(b) Since superheating is done partly in the radiant superheater a two-fold purpose is served. Gas temperature leaving the furnace can be reduced and danger of slagging is thus obviated.

(c) Steam generator characteristics are integrated with those of the turbine.

For further information, write to: **FOSTER WHEELER**



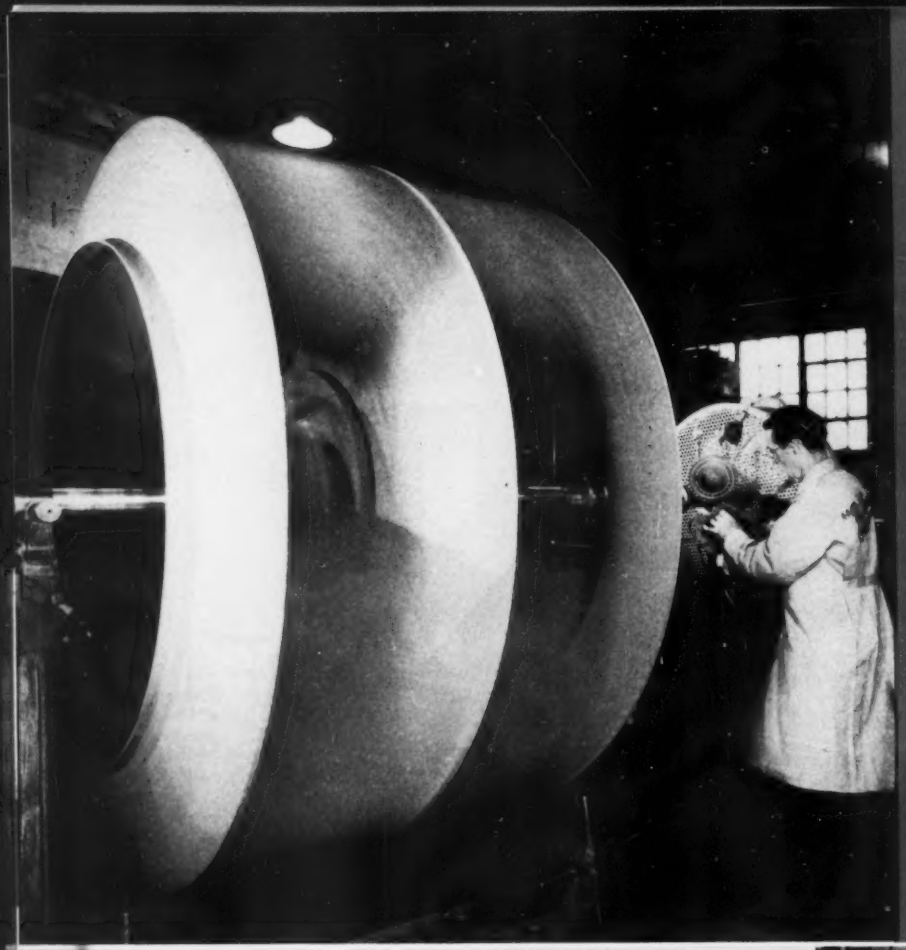
REHEAT— Four 700,000 lb per hr steam generators for an important midwest utility.

REHEAT—A 1,100,000 lb per hr steam generator for a large steam-electric station in central Pennsylvania.

REHEAT AND DUAL CIRCULATION—A 1,450,000 lb per hr reheat and dual circulation steam generator for a steam-electric plant in New York City. Dual Circulation, a Foster Wheeler development, makes possible the reduction of silica carryover to negligible quantities.

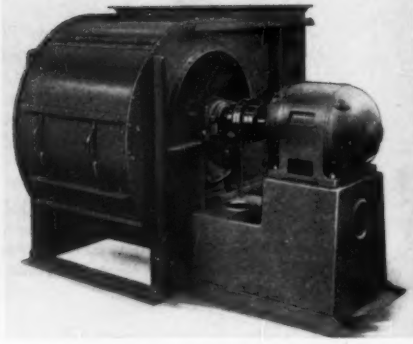
CORPORATION • 165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

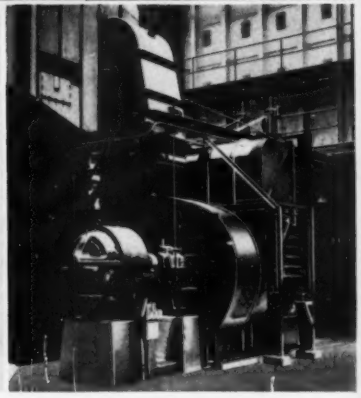


Left, large or small, every "Buffalo" rotor is dynamically balanced on a precision balancing machine before shipment. Even the largest rotors, like this double-width type, receive this treatment.

INDUCED DRAFT — "Buffalo" Single Width Induced Draft Fan with One Inlet Box and Water Cooled Bearings.



FORCED DRAFT — "Buffalo" Double Inlet Forced Draft Fan with Ball Bearings Mounted on Housing.



"Buffalo" Combination Draft Fans in Oil Refinery. Forced and Induced Draft Rotors Mounted on Common Shaft with Independent Pedestals and Bearings on Outboard Ends of Unit.

"Buffalo" First for

BALANCE...

MAKES A BETTER FAN

ANOTHER REASON FOR TOP PERFORMANCE

IN "Buffalo" DRAFT FANS

Every "Buffalo" Draft Fan rotor is balanced on a modern, dynamic balancing machine. This means much to the performance of the fan on the job, as every operating man knows. Smooth, vibration-free operation means elimination of bearing troubles, noise, and worry over shut-downs.

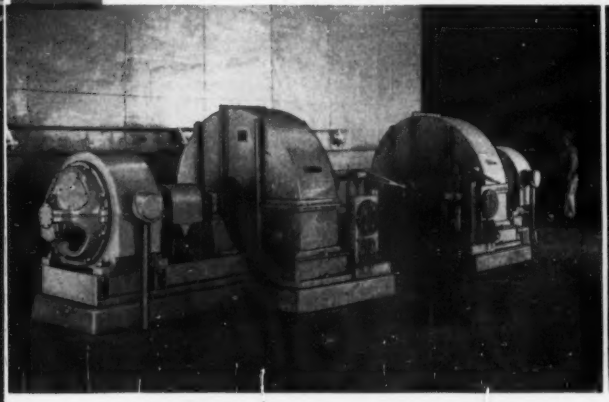
Of course, other things beside balance are important in draft fans — rugged construction, accessibility, high efficiency. "Buffalo" fans have these characteristics, too, as you see from Bulletin 3750, which gives complete construction details. Write for a copy.

BUFFALO FORGE COMPANY

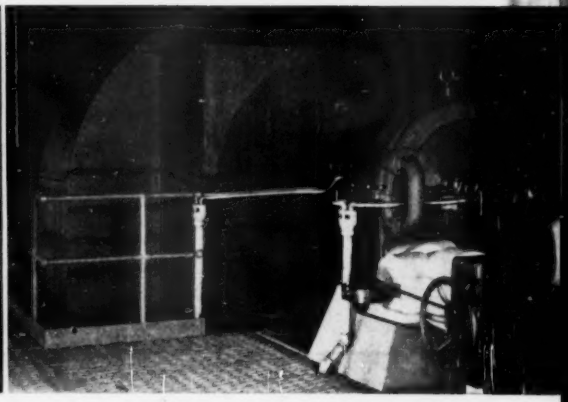
488 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities



PRIMARY AIR — "Buffalo" Primary Air Fans blowing heated air mixed with pulverized coal into combustion chamber. A punishing, high pressure job for any fan, but all "Buffalo" Draft Fans are built to stand the service.



CINDER ELIMINATING — "Buffalo" Induced Draft Fan and Cleaning Equipment in One Compact Unit — requires less power than with separate fan and dust system, costs less and takes less space.

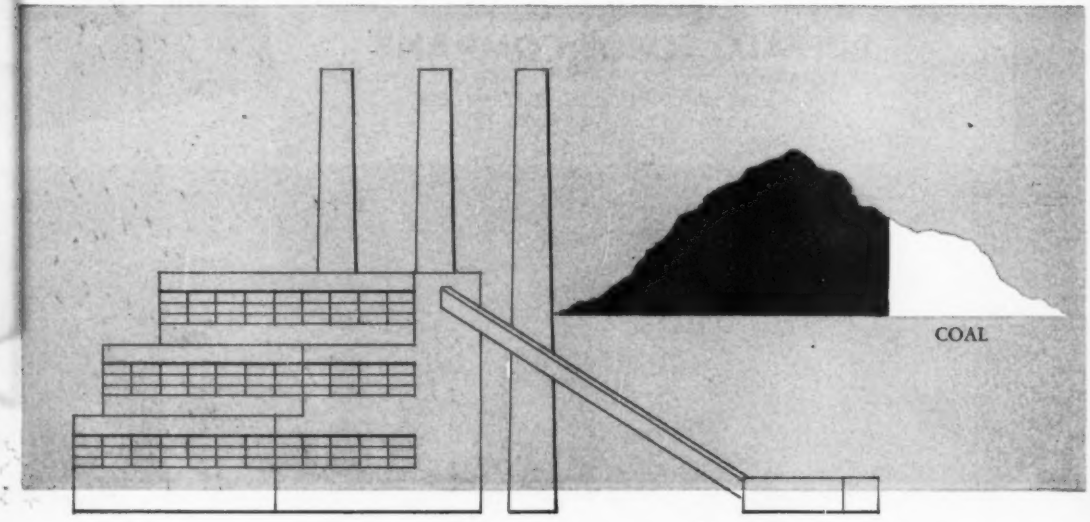
MECHANICAL DRAFT FANS

How much fuel can you

When you buy a combustion control system, the second best system is not good enough. No matter what it costs, it is too expensive. Too little air means unburned fuel, while too much air means heat wasted up the stack. Slight variations in either direction can, in a few years, cost more in wasted fuel than boilers and control systems together.

Hagan Automatic Combustion Control Systems are designed for *precise* control. When they are placed in service, they are adjusted by Hagan's experienced combustion engineers, who make sure that you *get* the precision which is built into the Hagan control system.

Hagan controls are used on every size of boiler from 5,000 pounds per hour at 3 psi. to 1,340,000

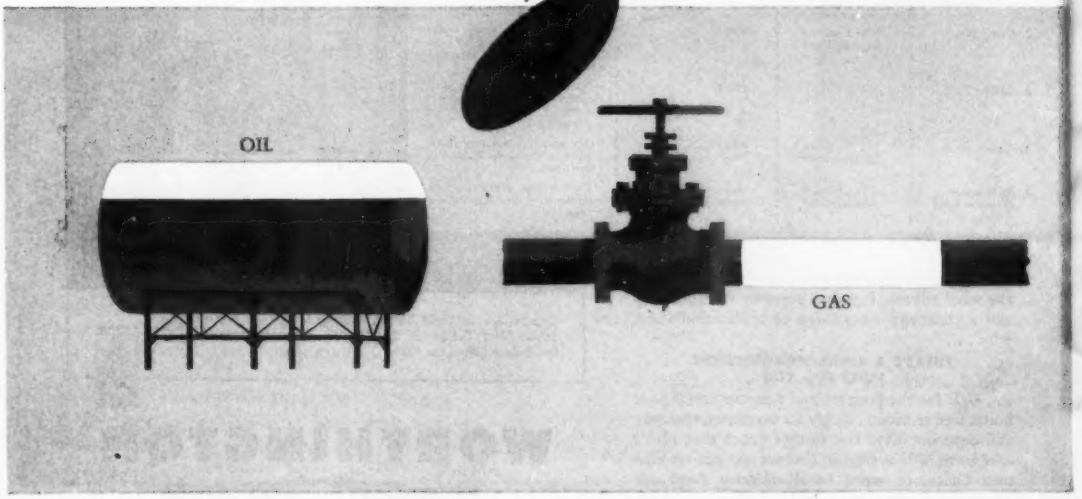


HAGAN HALL BUROMIN CALGON

afford to throw away

pounds per hour at 1800 psi. They have been applied to boilers burning oil, coal, gases of various types, even on boilers burning sawdust —and always with satisfactory results.

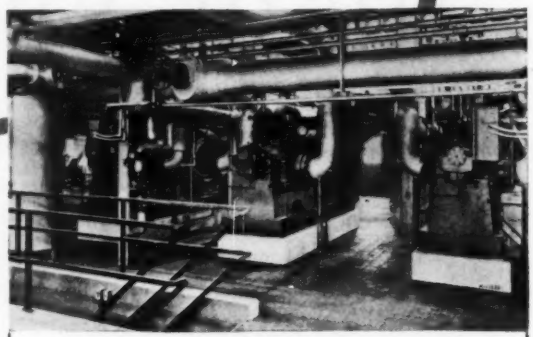
Our engineers will be glad to give you full information on Hagan control systems. Write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pennsylvania.



HAGAN CORPORATION

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

What Metals Are Best For Centrifugal Boiler Feed Pumps?

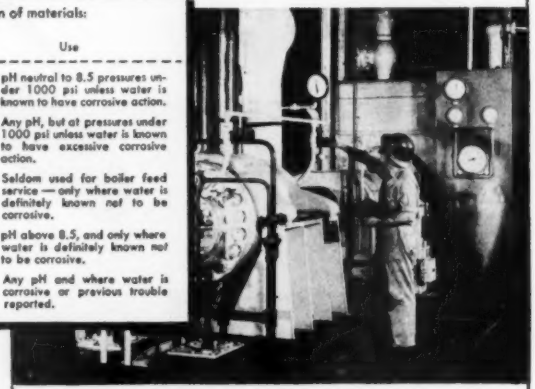


Three Worthington Axially Split Centrifugal Boiler Feed Pumps At The Kansas Power And Light Company Plant, Hutchinson, Kansas.

Drawing on their long experience in the field of hydraulics, Worthington engineers produce boiler feed pumps that are metallurgically correct in design, meeting every requirement as to temperature, pressure and corrosion-erosion resistance. As a result, Worthington boiler feed pumps perform better and last longer.

The following table represents Worthington's recommendation of materials:

Casing	Fittings	Maximum Temperature	Use
1. Cast Iron	Bronze	250 F	pH neutral to 8.5 pressures under 1000 psi unless water is known to have corrosive action.
2. Cast Iron	13% Chromium Stainless Steel	350 F	Any pH, but at pressures under 1000 psi unless water is known to have excessive corrosive action.
3. Carbon Steel	Bronze	250 F	Seldom used for boiler feed service — only where water is definitely known *not* to be corrosive.
4. Carbon Steel	13% Chromium Stainless Steel	400 F	pH above 8.5, and only where water is definitely known *not* to be corrosive.
5. 5% or higher Chromium Steel	13% Chromium Stainless Steel	Any temperature normally encountered	Any pH and where water is corrosive or previous trouble reported.



One of Several Solid Barrel, Radially Split, High Pressure Boiler Feed Pumps at the Trenton Channel Station of the Detroit Edison Co.

This proven selection of materials coupled with the most advanced design, superior workmanship and a thorough knowledge of application show why . . .

THERE'S A *RIGHT* WORTHINGTON PUMP FOR YOU

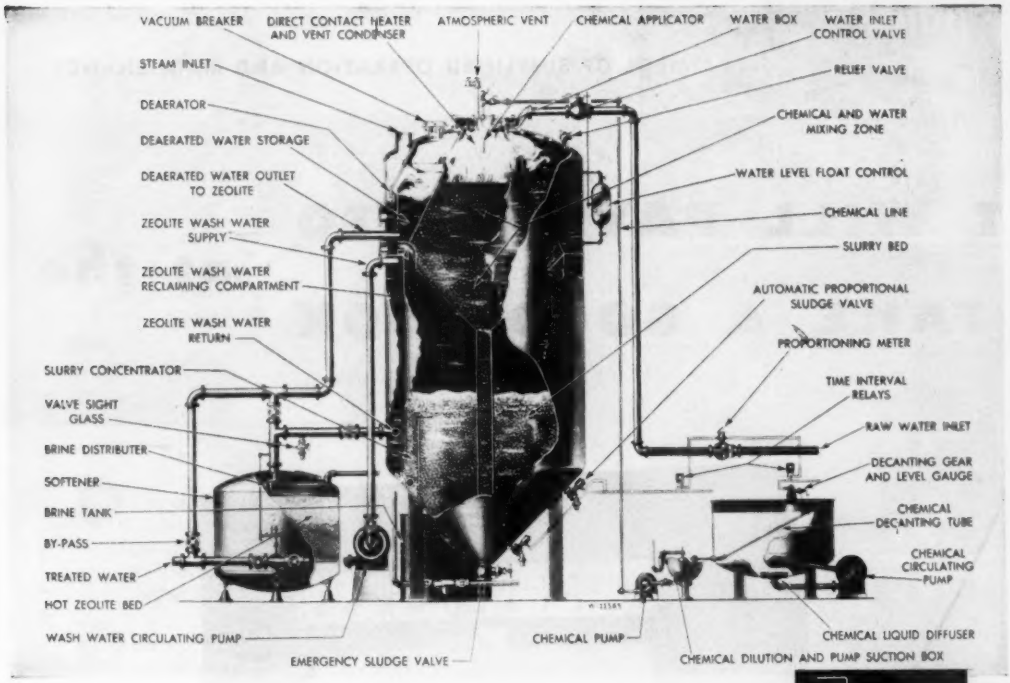
. . . *right* for the pressure and temperature of your boiler feed service . . . *right* for maximum economy and dependability. For further proof that *there's more worth in Worthington*, contact our nearest District Office, or write to *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

WORTHINGTON

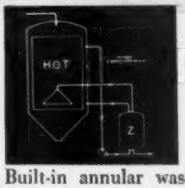
C1.2

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB

For Boiler Feed Service
Capacities to 1500 GPM
Heads to 1000 Ft.
For Hotwell, Condensate, Chilled Water Service
Capacities to 1400 GPM
Heads to 650 Feet
For Boiler Feed Service
Capacities to 1300 GPM
Heads to 1600 Feet
For Water Works, Circulation, Drainage, General Service
Capacities to 135,000 GPM
Heads to 400 Feet
For Boiler Feed Service
Capacities to 1600 GPM
Heads to 3500 Feet
For Boiler Feed Service
Capacities to 3000 GPM
Heads to 7000 Feet



Here's how to make water softening a soft job for you



You have less to do . . . to worry about . . . to pay for—when you use Worthington's revolutionary Hot-Z Slurry-Type Deaerating Water Softener.

It combines all the best features of Hot Process and Zeolite, plus these Worthington-originated features:

No more scaling trouble. Direct-contact vent condenser eliminates scaling trouble experienced with old-fashioned shell-and-tube types.

Supervision reduced. Concentrated sludge is removed automatically and proportionately to water volume.

Assures uniformity. Hydraulic chemical mixer assures uniformity of chemical strength. Also saves space.

Easier cleaning of valve-type wash water sight glass.

Better deaeration. Steam-jet deaeration is simpler, gives better efficiency—removes oxygen to .005 cc per litre.

Independent backwash system. Built-in annular wash water compartment provides clear hot water for backwashing and reclaims it without affecting operating velocities in treating zone. This feature not only pays off in systems employing filters, but also is ideal for backwashing the hot zeolite.

You also save because Worthington Hot-Z Systems operate on low-priced lime and salt. The average installation saves enough in chemical costs to pay for itself in 3 years!

Get all the facts!

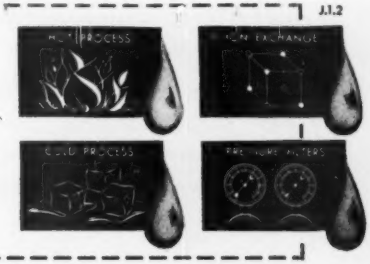
It will pay you to investigate the Worthington Hot-Z System thoroughly. Tell us your conditions of service and get our recommendation in terms of dollars and benefits. You'll find *there's more worth in Worthington.* Worthington Pump and Machinery Corporation, Water Treating Section, Dunnellen, N. J.

J.1.2

WORTHINGTON

WATER CONDITIONING

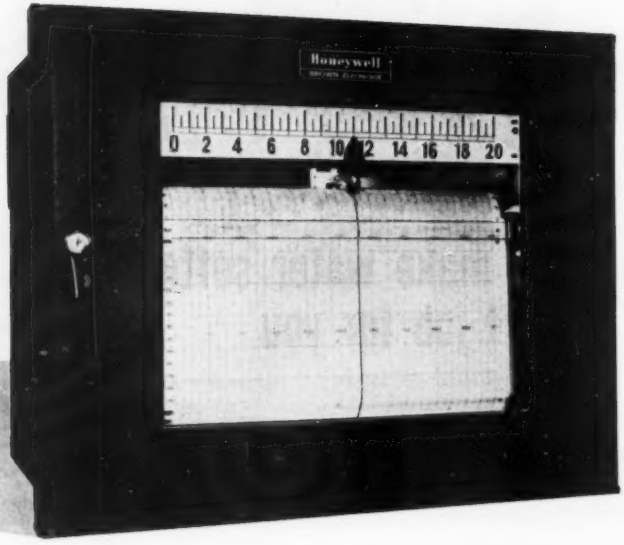
Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



Honeywell
BROWN INSTRUMENTS

. . . SYMBOL OF SIMPLIFIED OPERATION AND MAINTENANCE

IT WILL PAY YOU TO TAKE A GOOD LOOK at the



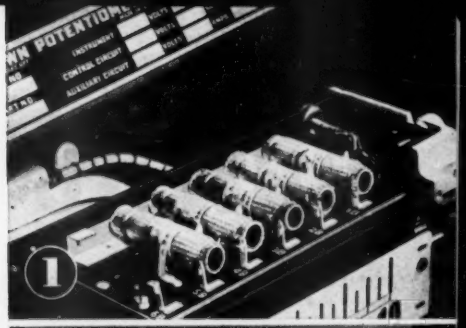
LIKE all other products that bear the Honeywell nameplate, the *ElectroniK* Potentiometer has established a reputation for sound design and construction, with flexibility . . . all of practical importance to superintendents, engineers and instrument men.

Thorough research, common-sense design engineering and practical field testing have contributed to the many features which add up to the simplified operation and maintenance of the *ElectroniK* Potentiometer.

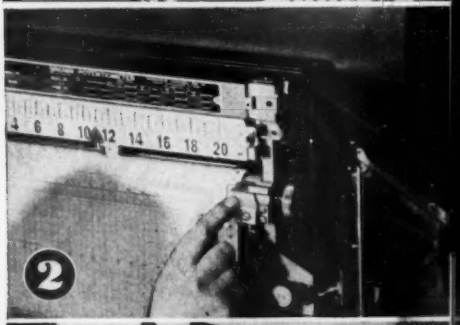
The chassis of all *ElectroniK* Potentiometers . . . Circular Scale and Circular Chart, as well as Strip Chart . . . swings out 180° to permit easy access to all components. Maintenance is simplified and time consuming dismantling for change of range or control unit is eliminated. Dowel fitted parts prevent misalignment of the swinging chassis.

ElectroniK

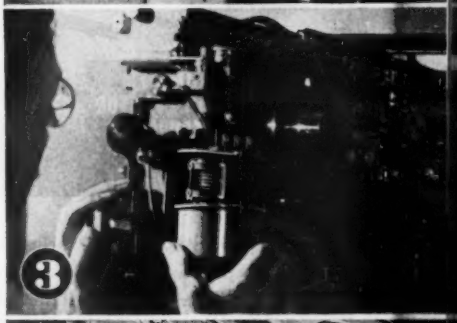
POTENTIOMETER



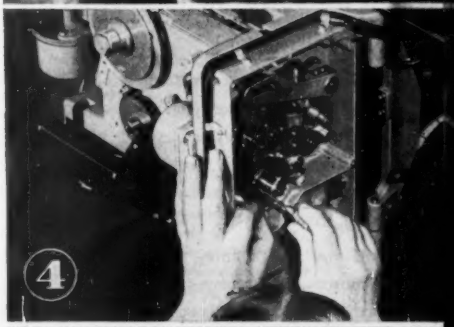
1 The circuit resistors are practically at your fingertips, making for easy range changes without removal of other components. Ranges may be varied for many sensing or detecting elements wherein an emf is created.



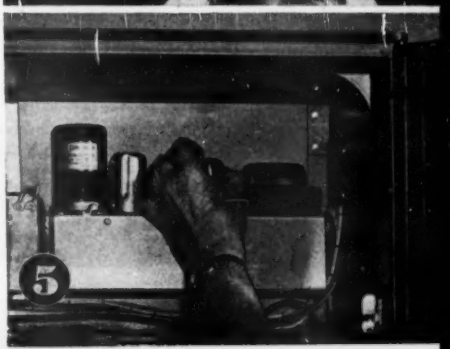
2 Easy to see and read is this pointer which indicates condition of the battery used to supply current to automatic standardizer.



3 The totally enclosed slidewire is easily accessible. Its many convolutions establish basis for the high sensitivity of the *ElectroniK* Potentiometer.



4 All mechanical parts are readily accessible for necessary lubrication and inspection of the instrument.



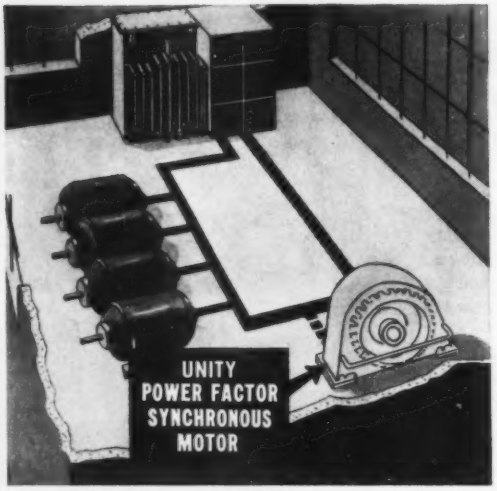
5 The amplifier of the *ElectroniK* Unit is readily accessible. This, plus unitary construction, adds much to the simplified operation and maintenance of this instrument.

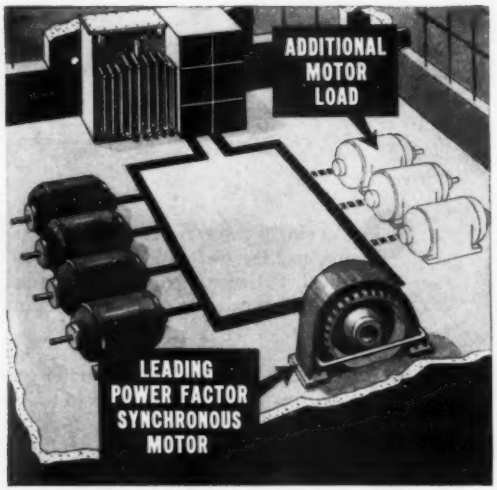
Take a *good look* at the five features presented here . . . and then call in your local Honeywell engineer for a discussion of their utilization in your plant. Catalog sent on request. MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

MINNEAPOLIS
Honeywell
Brown Instruments

How to get more out

. . . . *install G-E Synchronous Motors*





If your plant power system is loaded close to full capacity and you have a place where a large constant-speed motor can be used, you may be able to install a *unity power-factor* synchronous motor without increasing the kva load on your system.

Or, if your power system is already overloaded, then a *leading power-factor* synchronous motor can actually supply kvars to your system while performing its usual drive duties. Then you can often install additional inductive apparatus to an existing system without fear of overloading feeder lines.

If you are planning plant expansion or you need more motors and/or suspect power system overloading, contact the nearest G-E sales engineer. He'll help you survey your system, and help you determine the type of synchronous motor you need—should this be one answer to your power system problems. *General Electric Company, Schenectady, N.Y.*

NEW! A Helpful Training Course on Motors!

Everyone concerned with technical training problems will want this new G-E Motor Selection and Application Course. Consists of 9 short, easily understood lessons. Complete kit—slide films, review booklets and instructor's manual—$100. Call or write your nearest G-E sales office, or send for free copy of 96-page instructor's manual.

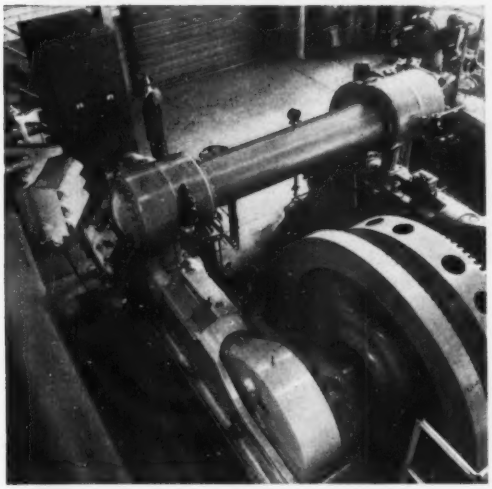
Look at the scope of this Course

1. Fundamentals of Motors
2. Types of Motors
3. Fundamentals of Selection
4. A-c Induction Motors
5. Single-phase Motors
6. D-c Motors
7. Synchronous Motors
8. Adjustable-speed Drives
9. Gear Motors

GENERAL ELECTRIC

# of your power system

for unity and leading power-factor drives

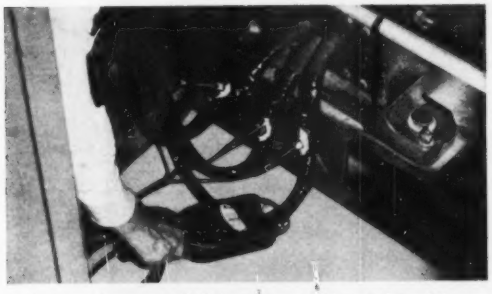


Control, too, will protect your system—G-E Limitamp high-voltage control provides ample interrupting capacity, protection for operating personnel, good appearance, and compactness. Here it controls and protects a 35° hp G-E synchronous motor.

G-E SYNCHRONOUS MOTORS ARE DRIVING . . . .

pumps
compressors
Jordans
beaters
crushers
ball mills
tube mills
large conveyors
blowers
saws
generators
rolling mills
pulp refiners
chippers
flour mills
stock refiners
line shafts
fans . . . .

in all types of industries where their efficiency, low first cost, and reliability make them exceedingly popular.



Check power factor on individual circuits—easily, quickly—with new G-E hook-on power-factor meter. This portable instrument hooks around the line—no cutting of conductors, no costly shutdowns to make power checks. You can accurately locate those circuits where corrective action is needed.

General Electric Co. Sect. P770-25
Schenectady 5, N. Y.

Please send me the following literature. .

- ☐ for reference purposes
- ☐ for planning an immediate project

( ) GER-234—Synchronous Motors Do Two Jobs at One Time
( ) GEA-5332—Low-speed Synchronous Motors
( ) GEA-5426—High-speed Synchronous Motors
( ) GEA-5469—G-E Testing Instruments
( ) GEZ-310—Motor Training Course Instructor's Manual

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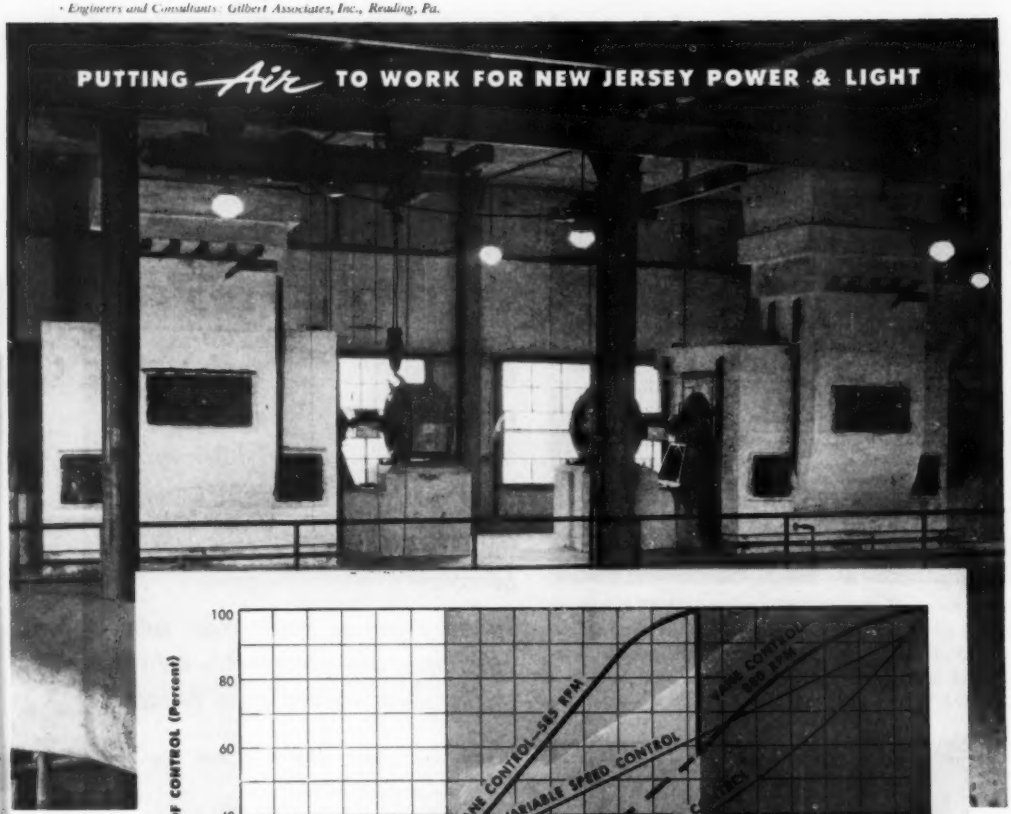
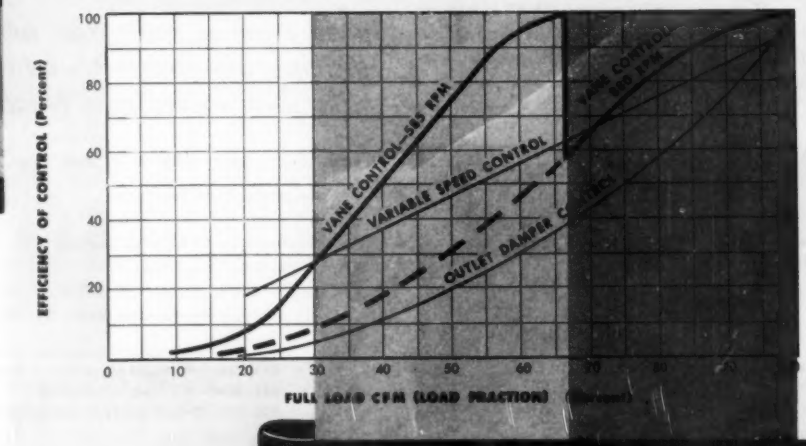
For ECONOMY

• *Engineers and Consultants: Gilbert Associates, Inc., Reading, Pa.*

PUTTING *Air* TO WORK FOR NEW JERSEY POWER & LIGHT





If you operate in this range—and
New Jersey Power & Light does—
VANE CONTROL is the economical choice.

$$\text{Ideal Part Load Fan Power} = (\text{Full Load Fan Power}) \times (\text{Load Fraction})^3$$

$$\text{Efficiency of Control} = \frac{\text{Ideal Part Load Fan Power}}{\text{Actual Load Input}}$$

Plus FLEXIBILITY...

STURTEVANT

VANE CONTROL®

WITH TWO-SPEED MOTORS

When New Jersey Power & Light selected Sturtevant Induced Draft Fans for the new No. 3 boiler in their Gilbert Station at Milford, they wanted greater flexibility *plus* economy over a wide range of operation. They achieve this by using the two TURBOVANE® ID Fans shown at left, each drawing 192,000 cfm at 16.9" static pressure and 315°F. Each fan is equipped with power-saving VANE CONTROL and driven by two motors—one at 880 rpm and one at 585 rpm. As plotted on the accompanying chart, this arrangement provides the maximum economy of operation over their entire load range, with greater flexibility.

This installation illustrates once again the dependable, economical performance which central stations and industrial power plants have come to recognize as the outstanding features of Sturtevant Mechanical Draft equipment. These features explain the many *repeat* orders for Sturtevant Forced and Induced Draft Fans from satisfied customers.

If you are interested in *putting air to work* efficiently, contact your nearest Westinghouse-Sturtevant Office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

YOU CAN BE SURE...IF IT'S

Westinghouse

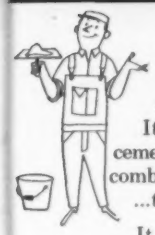
PUTTING *Air* TO WORK

J-80236A

There's an

Eagle-Picher Insulation

that can help you control temperatures accurately...economically!



Here's just one of the many efficient, economical Eagle-Picher Insulations. It's Eagle-Picher one-coat, all-purpose cement—a revolutionary new product that combines insulating and finishing materials ...that goes on in one easy-to-apply coat.

It gives your equipment highest possible thermal efficiency ... cuts operating costs by saving fuel... and helps to provide perfect, precise control on temperatures.

Whatever your requirements ... there's an Eagle-Picher Insulation that can fit your needs. Find out about them right away!

THESE EAGLE-PICHER PRODUCTS CAN SAVE YOU MONEY ... POWER ... TIME

Insulating Felts • Supertemp Blocks • Blankets Loose Wool • Pipe Covering • Stalastic Insulseal • Insulstic • Swetchek • Finishing Cements • Insulating Cements • Fireproofing Cement • Diatomaceous Earth Blocks

EAGLE-PICHER ONE-COAT, ALL-PURPOSE CEMENT!

A combination insulation and finishing material for temperatures to 1000 F. It's quick setting, rust-inhibitive ... has light color, smooth surface, negligible shrinkage. It has exceptional adhesive qualities on ferrous metals and insulation materials. And it's unaffected by rain or moisture after it sets!

EAGLE EP PICHER

THE EAGLE-PICHER COMPANY • *General Offices: Cincinnati (1), Ohio*

Insulation products of efficient mineral wool — for a full range of high and low temperatures.

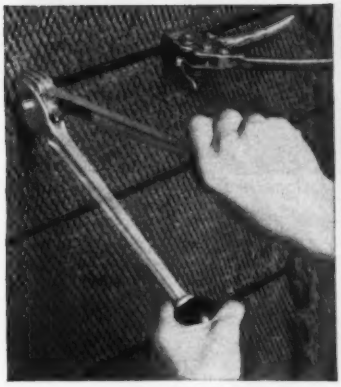
Technical data on request.

Since 1843.

2172 R1

These efficient, versatile insulations "team up" to give perfect insulation for every major application

For a completely effective, low-cost insulation combination, you can't beat the teamwork of Eagle-Picher Mineral Wool Blankets, Supertemp Blocks, Diatomaceous Earth Blocks and Earth Fill, and Super "66" Cement. They work effectively to give your equipment highest possible thermal efficiency . . . cut operating costs by saving the maximum amount of fuel . . . and help to provide perfect, precise control over temperatures.

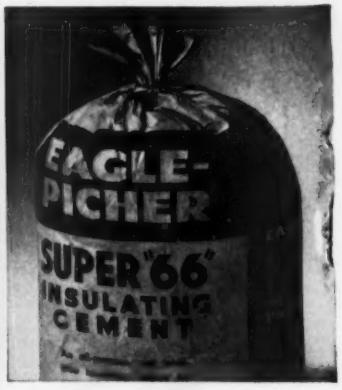


EAGLE-PICHER MINERAL WOOL BLANKETS

These blankets satisfy the need for a convenient method of quickly and efficiently insulating flat or curved surfaces on larger types of heated equipment. Mineral wool is felted and secured between flexible metal fabric. Outstanding physical and chemical stability enables Eagle-Picher Blankets to resist water, steam, corrosive fumes and normal vibration.

EAGLE-PICHER SUPERTEMP BLOCKS

Eagle-Picher Supertemp Blocks are lightweight (approximately 16 lbs. per cu. ft.). Can be cut easily with knife or saw to fit off-shaped areas . . . they fit snugly over minor irregularities. They're strong and have high refractory value. Withstand temperatures up to 1700 F. Conductivity at 512 F. approximately 0.53 . . . all standard sizes, from 2" x 18" to 12" x 36" in thicknesses from 1" to 4".



EAGLE-PICHER SUPER "66" INSULATING CEMENT

Super "66" is all-purpose, rust-inhibitive, extremely adhesive insulating cement. "Springy ball" pellets don't collapse after application . . . give great coverage, retain their thermal efficiency. 100 lbs. covers approximately 55 sq. ft. —1 inch thick. Easily applied with trowel, over flat and irregular surfaces. Efficient for temperatures up to 1800 F. Reclaimable when used on equipment whose temperatures do not exceed 1200F.

Eagle-Picher, as a member of the Industrial Mineral Wool Institute, urges that you look for this label. It is a certification by the manufacturer that his mineral wool product conforms to Commercial Standard CS 117-49 as issued by National Bureau of Standards, U.S. Department of Commerce in cooperation with the Industrial Mineral Wool Institute, New York, N.Y.

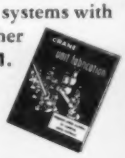
no unit fabrication job too tough for CRANE

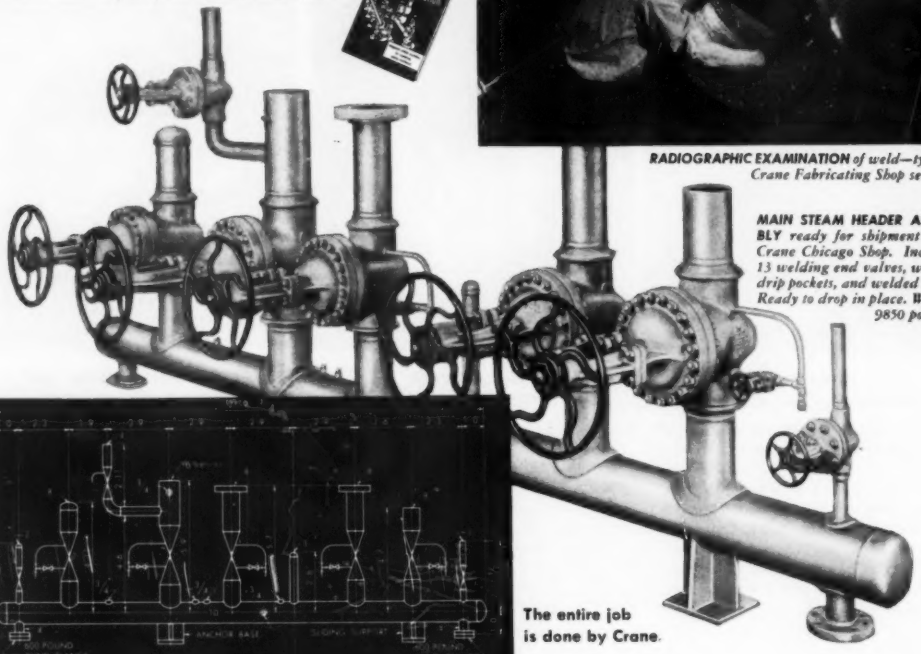
Whether your piping project calls for a simple pipe bend . . . or a complex welded assembly . . . Crane fabricating facilities can handle it. No pipe shop is better equipped to do your *entire* job from drawings of *your* design.

At Crane all steps of fabrication—such as bending, welding, stress relieving or heat-treating, radiographic examination, hydrostatic testing—are rigidly checked under procedure control to maintain adequate standards of accuracy and quality.

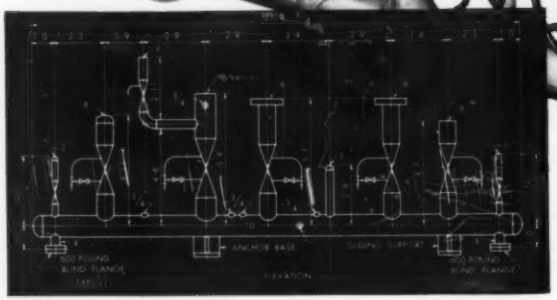
And because each assembly is tested as a unit, with major assemblies proved in advance of installation—you can erect your piping systems with minimum expense and delay. For further information, **ask for Folder AD-1771.**

RADIOGRAPHIC EXAMINATION *of weld—typical Crane Fabricating Shop service.*





MAIN STEAM HEADER ASSEMBLY *ready for shipment from Crane Chicago Shop. Includes 13 welding end valves, welded drip pockets, and welded bases. Ready to drop in place. Weight 9850 pounds.*



The entire job is done by Crane.

CRANE

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

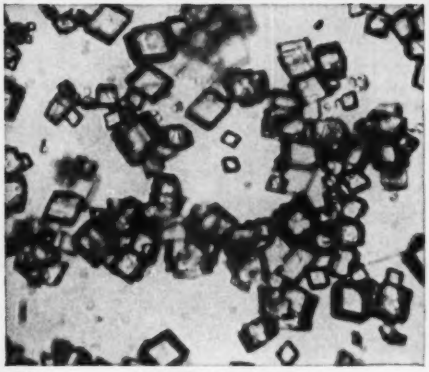
VALVES • FITTINGS • PIPE • PLUMBING • HEATING

ALLIS-CHALMERS

No. 26 Series

ORGANIC SLUDGE DISPERSIVE

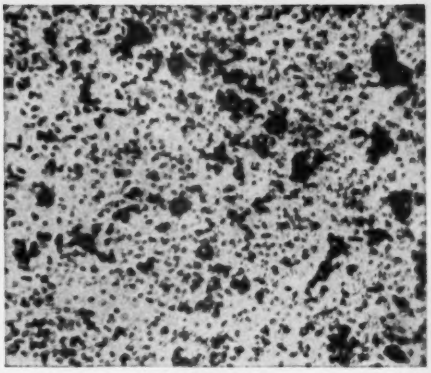
Controls Sludge-Scale



500X

UNTREATED

Note large crystal size



500X

TREATED

Inhibited crystal growth and dispersion keep sludge fluid

BOILER SLUDGE CAN FORM SCALE . . . because of its inherent tendency for adhering to heat transfer surfaces.

The dispersive property of Allis-Chalmers No. 26 Treatment prevents crystal growth and produces a fluid sludge, readily removed by blowdown.

To you, the engineer, this means cleaner boilers — boilers that seldom if ever require turbining or other forms of cleaning. No. 26 Treatment does not soften the water, but it can be mixed with softening chemicals (if desired) without reducing its effectiveness as a sludge conditioner. This simplifies its application and reduces your investment in feeding devices.

A COMPLETE, BRIEF discussion of the Allis-Chalmers No. 26 Series organic sludge treatment is available in our bulletin number 28X7543. (Coupon below for your convenience.)

Allis-Chalmers
Milwaukee 1, Wis.

Gentlemen:
Please send me Bulletin 28X7543.

Name .....

Title .....

Company .....

Address .....

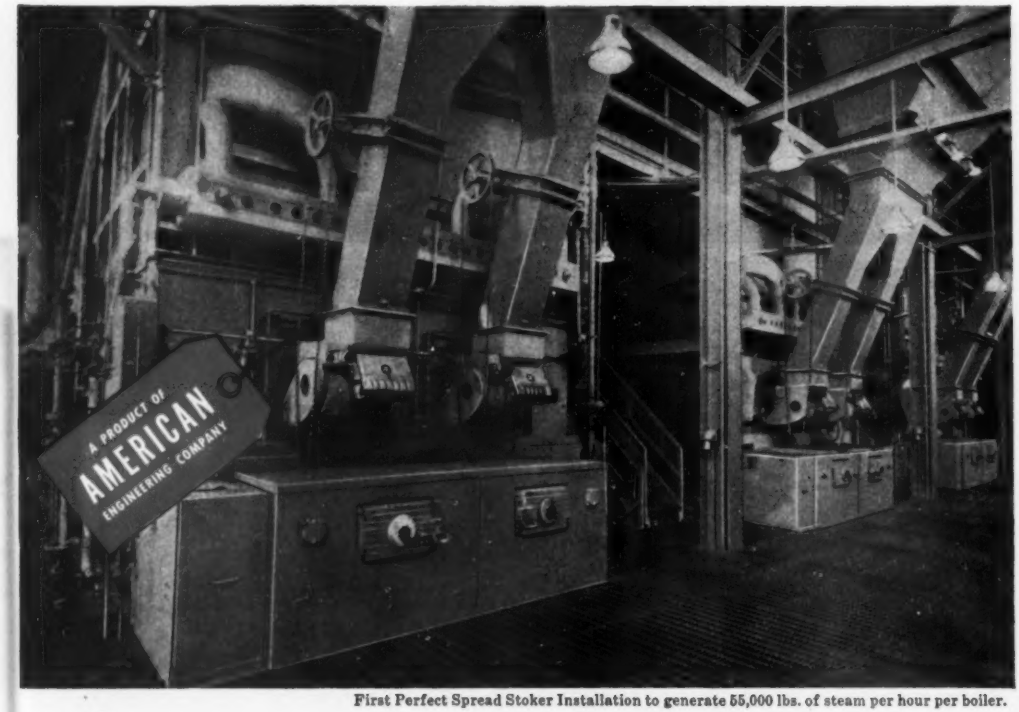
City ..... State A-3469

ALLIS-CHALMERS

Water Conditioning

✓EQUIPMENT ✓CHEMICALS ✓SERVICE

1... 2... and now a 3rd order for



First Perfect Spread Stoker Installation to generate 55,000 lbs. of steam per hour per boiler.

Day and night, for weeks at a time, Spreader Stoker continuously releases 700,000 B.T.U. per hour per square foot of active grate area

1 IN THE FALL of 1949 a very well known corporation installed three AE Perfect Spread Stokers to generate 55,000 lbs. of steam per hour each in one of its midwest plants.

2 Months later the Company needed more steam from larger boilers in another plant where the existing stokers had been designed to burn 12,300 B.T.U. per pound coal. Over the years, however, the available coal dropped to as low as 9500 B.T.U. per pound so the plant could not carry the required load.

On the basis of proved performance, an AE Perfect Spread Stoker was installed as a replacement... and here's the record:

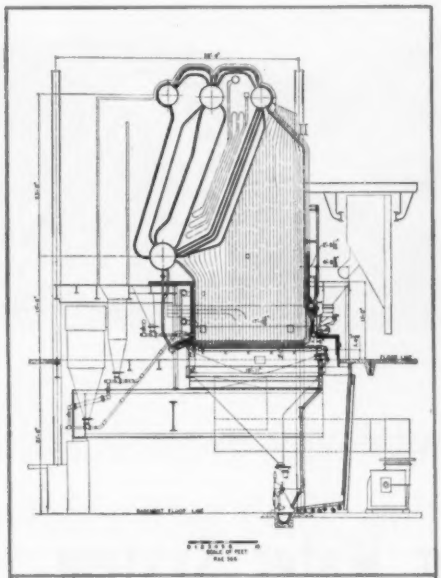
The Perfect Spread has averaged better than 180,000 lbs. of steam per hour—24 hours a day—7 days a week for weeks on end. Efficiency is about 84% and the release rate exceeds 700,000 B.T.U. per sq. ft. of active grate area per hour! In terms of sustained results per sq. ft. of grate surface this is probably the highest duty spreader stoker installation in the world. With an increased manufacturing load they now find they can carry 200,000 lbs. per hour.

3 And now, again on the basis of performance, the same company has ordered two more duplicate Perfect Spread Stokers.*

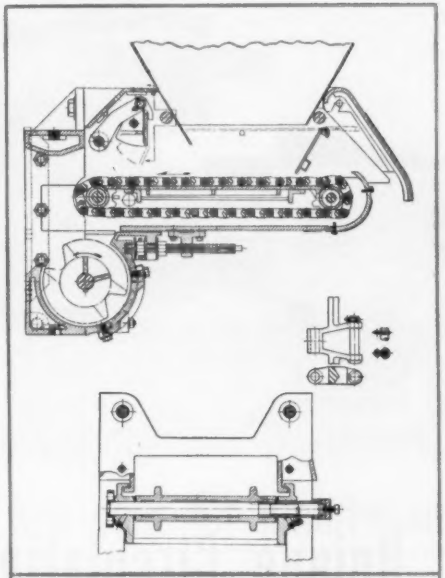
AE Perfect Spread Stokers burn high and low ash coals with practically equal efficiency. They assure positive, continuous coal feed and unbe-

*AS THIS MESSAGE WAS GOING TO PRESS, THE ABOVE COMPANY PLACED A FOURTH ORDER FOR A PERFECT SPREAD STOKER.

PERFECT SPREAD STOKERS



Second larger installation of Perfect Spread Stoker actually giving 200,000 lbs. of steam per hour from a single boiler.



NON-CLOGGING CONVEYOR FEEDER: Coal enters feeder from hopper, and is conveyed positively, continuously and uniformly forward. Coal is not fed in slugs.

lieveably even distribution. *They never clog on wet coal.*

Perfect Spread Stokers have a capacity range from 8,000 to 500,000 lbs. of steam per hour... coal feeders are adjustable from 50 lbs. to 7500 lbs. of coal per hour. Mail coupon today for a copy of the Perfect Spread Stoker booklet and for a reprint of a new report on large spreader stokers. Also, if you are now considering a boiler in capacities from 300,000 to 500,000 lbs. of steam per hour, let's arrange to get together and discuss cross-firing.

WON'T CLOG ON WET COAL

AE

AMERICAN ENGINEERING

COMPANY

PHILADELPHIA 25, PENNA.

AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

American Engineering Company
2400 Aramingo Avenue
Philadelphia 25, Penna.

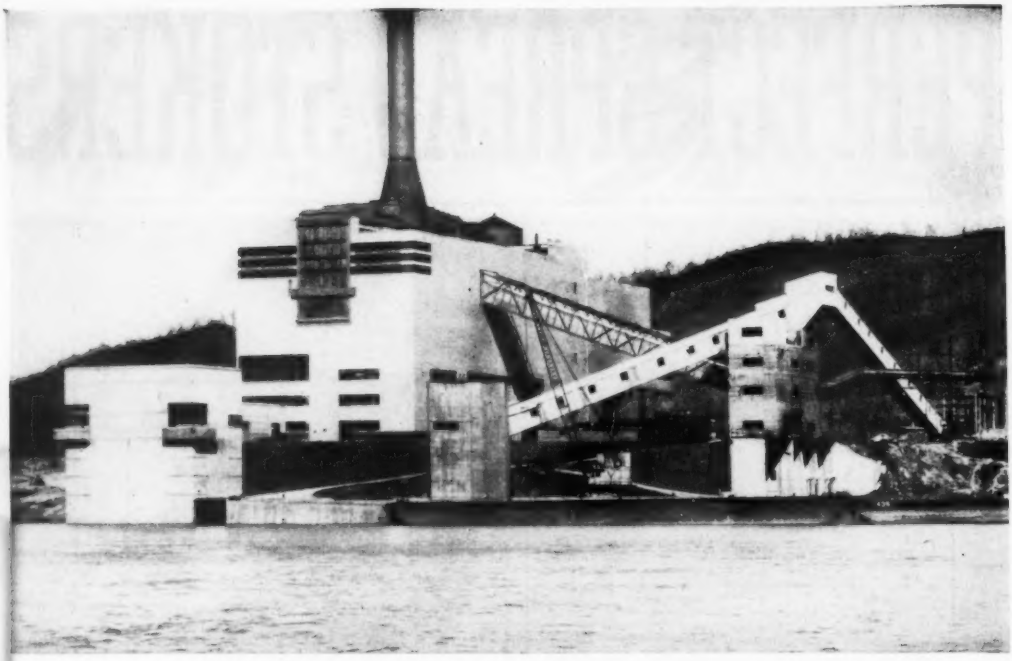
Gentlemen: Kindly send me free copy of Perfect Spread Stoker booklet and new stoker report ☐. I should like to discuss cross-firing ☐.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State____



Unique Circulating Water System Installed in This Power Plant

The R. E. Burger steam-electric plant of Ohio Edison Company is located on the Ohio River well above flood stage—which may reach as much as 60 feet above extreme low water. Water is supplied to the condensers by a patented circulating water system pioneered jointly by Worthington and the consulting engineer, Mr. George W. Saathoff.

All major equipment except circulating pumps, which are designed to operate completely submerged if necessary, are located above flood stage.

The new installation of a Worthington 70,000 sq ft two-pass condenser and auxiliaries, serving a 90,000 kw turbine-generator, is the third Worthington unit in this station. Two 46,000 sq ft condensers were previously installed.

For advice on any new installation or information on a wide range of power plant equipment, consult Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, New Jersey.

HOW IT WORKS

Two full-capacity circulating pumps are used in series.* The primary pump, submerged below extreme low water, is a Worthington motor-driven HIFLO. Its high starting head characteristic is able to deliver enough water for starting purposes. A booster pump—a single-suction volute Worthington MIXFLO, mounted directly upon an hydraulic turbine—starts when there is enough water in the control well. The two pumps then operate automatically in series at full capacity.

Advantage is taken of maximum siphon effect from the condenser drop leg which enters the sealing or control well. From this well, all circulating water is passed through the hydraulic turbine. Thus the static head from sealing well to river level is utilized—75-80% being recovered—in reducing the work of the primary pump, with saving in overall pumping power.

The booster pump functions until rising water renders the turbine ineffective. Then the primary HIFLO works alone, producing full capacity under reduced head.

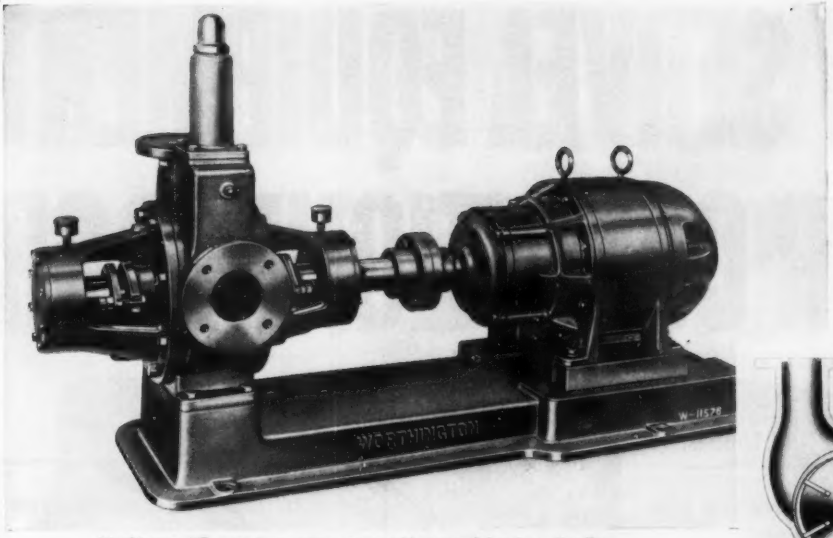
*In the new unit, there are two half-capacity primary pumps, permitting operation of only one in the winter when low water temperatures prevail.

Z.1.1

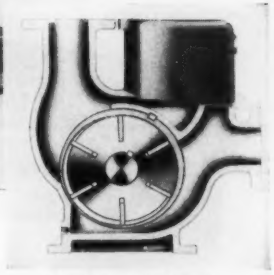
WORTHINGTON

WORLD'S BROADEST LINE OF STEAM POWER PLANT AUXILIARIES

Feed Water Heaters	Boiler Feed Pumps	Steam Turbines
Steam-Jet Ejectors	Water Treating Equipment	Surface Condensers



Worthington VE vane-type rotary pump with external bearings. Handles non-lubricating fluids, including water. Also, volatile liquids, without danger of fire.



Cross-sectional drawing of Worthington vane-type rotary.

This heavy-duty rotary handles non-lubricating fluids with low cost for maintenance

Now . . . Worthington offers you the *most complete* line of rotary pumps on the market, including:

heavy-duty vane-type pumps in both internal *and external bearing* models

Introduction of these pumps follows Worthington's policy of offering the greatest variety of pumps—so that *any* pumping job can be handled by a Worthington pump that fits the specifications exactly.

Many Advantages for Vane-Type Pumps

high displacement per revolution • smooth, non-pulsating flow • high suction lift • minimum number of parts • only one rotating element • vanes automatically compensate for wear.

And add *these* superior features of Worthington's vane-type pump—external or internal anti-friction bearing design • built-in adjustable relief valves • heavier-duty construction • suitable for higher pressures • removable liners • end plates and vanes reversible when worn • quiet and efficient operation due to large, unobstructed passages • maximum interchangeability permits minimum repair part inventory • all internal repairs made without breaking suction or discharge connection.

A COMPLETE LINE

Worthington makes vane-type pumps in standard fitted, all-bronze or bronze-fitted construction, with or without integral relief valves, internal or external bearings, in ranges from 25 to 1000 gpm and up to 200 psi.

Send coupon for new bulletin.

P,1.6

WORTHINGTON

ROTARY PUMPS

Worthington Pump and Machinery Corporation
Reciprocating Pump Division
Harrison, New Jersey

Please send Bulletin W485-B-1 on vane-type rotary.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

NEW SERVEL EQUIPMENT AIR-CONDITIONING OR

SERVEL ABSORPTION EQUIPMENT

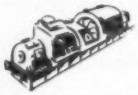
OPERATES ON ANY OF THESE SOURCES OF STEAM

GAS-OPERATED STEAM GENERATOR

INDUSTRIAL BOILER

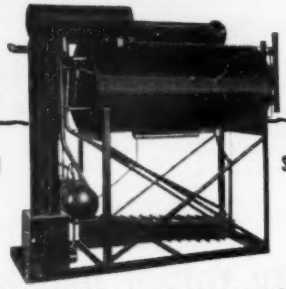
WASTE-HEAT BOILER

CONDENSATE STEAM GENERATOR



TURBINE EXHAUST STEAM

DISTRICT STEAM LINES



WATER CHILLER: Rated capacity under standard ASRE conditions—25 tons. Hermetically sealed absorption refrigeration system. Refrigerant, water. Absorbent, lithium bromide. Source of energy, steam. Refrigeration unit operates under a vacuum.

Self-Contained Unit: 5 tons of cooling, heating optional.

All-Year Air Conditioners. In 3-ton and 5-ton sizes. Cooling and heating. For single or multiple installation.

SUPPLIES CHILLED WATER OR AIR CONDITIONING FOR

INDUSTRIAL PROCESSING

FACTORIES

HOSPITALS

HOTELS

SCHOOLS

OFFICES

STORES

HOMES

SIMPLIFIES ALMOST ANY COOLING APPLICATION

- Light enough to install anywhere
- Runs on steam from any source, any pressure
- Electric-power needs are nominal
- Modulates down to 50% of capacity

NO MATTER how large or how small your cooling or air-conditioning job, the chances are that one of Servel's absorption units can do it better, easier, and at less cost.

If it's chilled water for industrial processing, or air conditioning large buildings that you're interested in, take a look at the new Servel 25-Ton Water Chiller. This latest addition to the Servel line runs on steam from any source, at any pressure. If waste steam or waste heat is available, you can operate on it and save most of the normal costs of fuel.

Electric-power needs are nominal, so you can usually connect to existing wiring. The unit is light, quiet, vibration-free—so much so that you can install it on any floor, without expensive bracing. It supplies chilled water in industrial processes, and—by the use of heat exchangers—will supply air conditioning in any building by simple piping.

For smaller areas, the Servel Self-Contained 5-Ton Air Conditioner, and the 3-ton and 5-ton units provide flexible, low-cost air conditioning. All Servel units have the famous Servel no-moving-parts cooling system. Thus you get long life, low maintenance, quiet, dependable operation.

Get complete information today. And if you'll enclose details of your process cooling or air-conditioning problems, we'll be glad to tell you which unit, or combination of units, our application engineers recommend. Servel, Inc., Evansville 20, Ind.

WHY SERVEL IS YOUR BEST AIR-CONDITIONING BUY

- **No Moving Parts in Cooling System To Wear Out**
- **Low Maintenance Costs**
- **Hermetically Sealed Circuits**
- **Long Life**
- **Completely Safe Operation**
- **Chilled Water Circuit Operates Under Normal Pump Pressure**
- **5-Year Factory Warranty**

SEND COUPON FOR MORE INFORMATION

Servel

AIR CONDITIONERS

FOR INDUSTRY • FOR HOME • FOR BUSINESS

Servel, Inc.
Department X210, Evansville 20, Indiana

Gentlemen:

Please send me more information on the following:

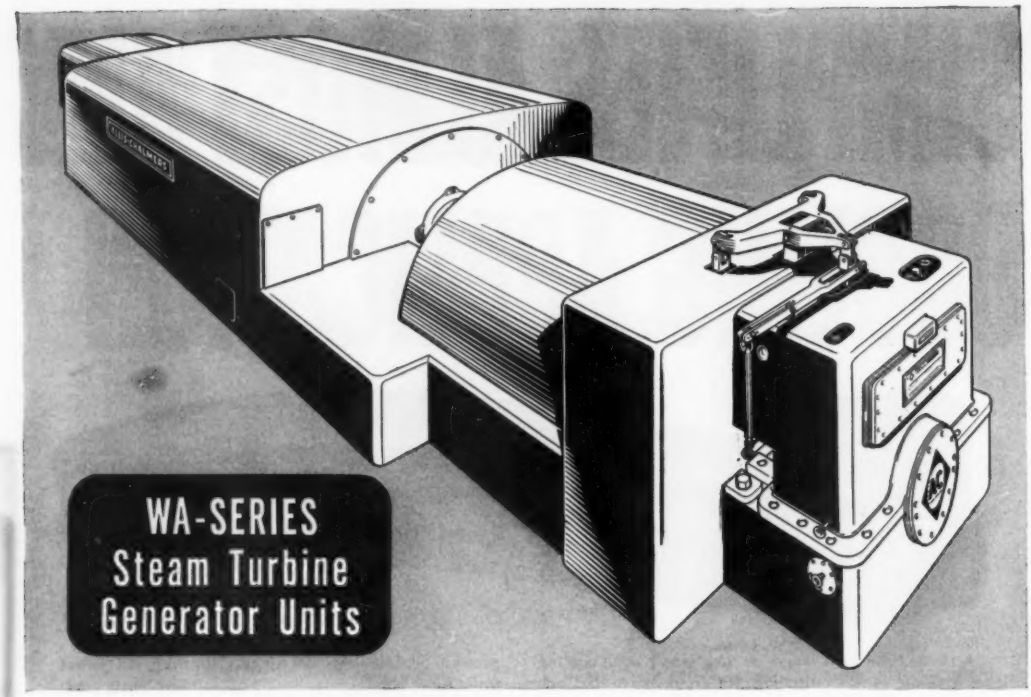
Servel 25-Ton Water Chiller_____
Servel Self-Contained Air Conditioner_____
Servel 3- and 5-Ton *All-Year* Air Conditioners_____

*Name*_____

*Firm*_____

*Address*_____

IF YOUR JOB CAN BE DONE BETTER WITH AIR CONDITIONING OR COOLING, IT CAN BE DONE BEST WITH SERVEL



Make Your Process Steam Serve Double Duty!

WHEN YOU'RE GENERATING process steam, you can save substantially by also generating electric power as a *by-product!*

For if you need a large amount of steam anyway, it costs only slightly more to establish higher pressure steam conditions for operating a turbine-generator unit as an efficient pressure-reducing valve. Process steam leaves the turbine at controlled pressure; power is generated as an economic by-product.

Allis-Chalmers modern WA-Series impulse steam turbine generator units are built especially for the economies inherent in such applications. WA-Series unit designs fit into your plant; tie in thermodynamically, as well as electrically paralleling with other units or systems.

They are being built in NEMA ratings through 7500 kw, for both condensing and non-condensing service, with or without automatic extraction. The WA-Series brings to the industrial and utility power plant the economies of repetitive manufacture as well as the design refinements proved by long steam turbine generator experience.

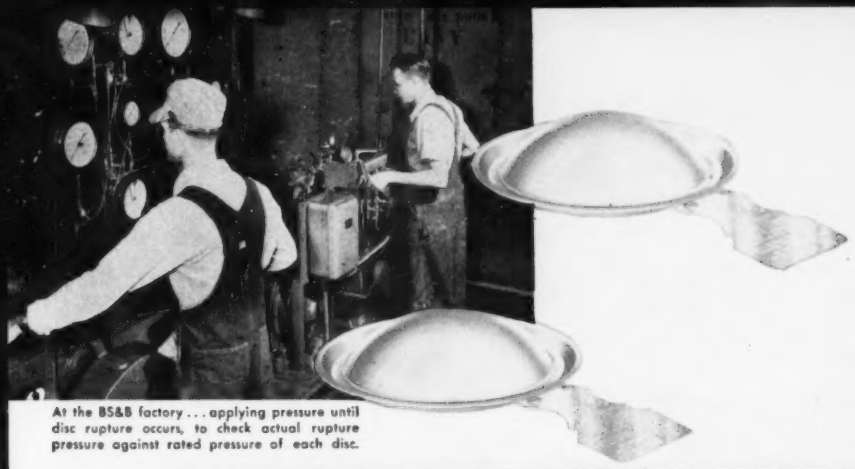
Purchaser convenience and simplicity are paramount in WA-Series design. Three-bearing construction, above-floor oil piping and bracket-bearing, housing type generator—all make a compact unit with simple foundation requirements.

Get the *full* story on the modern WA-Series! Be sure your next generating unit has *all* the latest features. Call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wis., for Bulletin 03B7664. A-3445

ALLIS-CHALMERS

TURBINES & GENERATORS | CONDENSERS & PUMPS | SWITCHGEAR & BREAKERS | MOTORS & CONTROL | TRANSFORMERS | WATER CONDITIONING

World's Widest Range of Power Plant Equipment



At the BS&B factory . . . applying pressure until disc rupture occurs, to check actual rupture pressure against rated pressure of each disc.

Money Can't Buy A Complete Lot!

. . . because a generous, scientific sample of SAFETY HEAD discs is ruptured at the factory to assure you of precision pressure protection. This is only one of many checks developed through BS&B's long experience in the exclusive manufacture of these versatile over-pressure relief devices. You can rely on SAFETY HEADS for instant, accurate action when needed!

No other relief device acts as quickly . . . full pipe-size opening afforded after disc rupture. If you have equipment under pressure, **you need SAFETY HEADS!**

Write today for free catalog, complete details. Ask about a free analysis of your pressure problem by a BS&B Engineer.

BLACK, SIVALLS & BRYSON, INC.
Adv. Dept. Rm. 259 7502 East 12th Street
Kansas City 3, Missouri

SAFETY HEADS
for
Positive Pressure Protection

Original 1500-kva single-ended G-E load-center substation installed on plant roof to conserve valuable floor space.

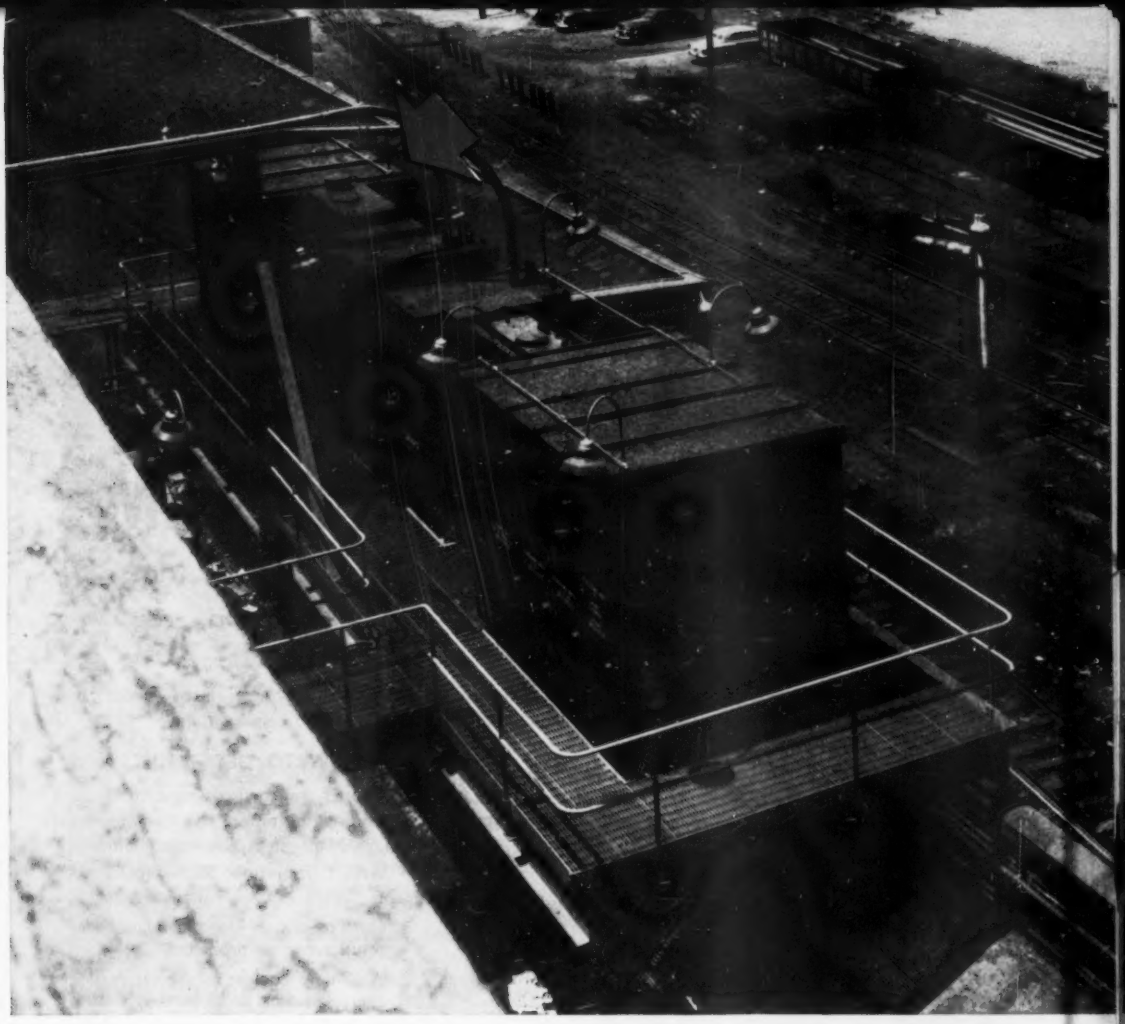
Foresight that paid off

POWER DISTRIBUTION SYSTEMS

Some time ago, an Eastern industrial put in a G-E load-center distribution system, knowing that the load served by one of its substations (above left) would probably double within five years. It actually doubled after *one* year.

With any other type distribution, the company would have eventually needed a bigger transformer, taxing the interrupting capacity of existing circuit breakers. Or had the original unit been twice needed size, investment would have been half-wasted for one year. Instead, the company waited until load doubled, then added another "building block" of power of the same economical size, keeping cost-per-kva at optimum. This load area is now fed by two 13,200-volt feeders, one to each transformer, for greater reliability.

What's more, the new substation was installed,



Recent addition of second 1500-kva substation, installed beside original one. Load area is now reached by two high-voltage feeders.

when power needs doubled

connected and energized without disrupting existing service. *Nothing already done was undone.* Your nearest G-E sales office can help you find the best way to distribute power in *your* plant during these years of expansion. *General Electric Company, Schenectady 5, N. Y.*

854-40

GENERAL ELECTRIC

what *results*

do you want from your

COMBUSTION CONTROL SYSTEM ?

Of course you want the best results you can get. But, more particularly, you want *specific results to solve your combustion problems.*

Hays engineers "focus" on your problems. They have the experience in planning combustion control systems to give you specific results like:

- **smoke abatement**
- **reduced boiler room labor costs**
- **decreased outage**
- **constant steam pressure**
- **lower fuel bills by means of switching fuels**
- **increased boiler capacity**
- **firing mixed fuels efficiently**
- **rapid response to steam demand**

Such specific results are described in the published "Case Histories" listed at the right. Here's how you can get them—

HOW TO GET RESULTS

Send a brief statement of your combustion problem and the results you want to Orval W. Riggs, Manager, Application Engineering, The Hays Corporation, Michigan City (3), Indiana. In return, you will receive:

1. Our preliminary recommendations for a solution to *your* problem.
2. A 48-page booklet on the various Hays control systems and how they work.
3. The five "Case Histories" giving details of Hays control, "getting results" on five different problems at leading companies throughout the country.

HAYS COMBUSTION CONTROL

Low maintenance?

"we find that due to the (Hays) properly controlled combustion, our maintenance on both stokers and boilers has been considerably decreased."

American Tobacco Company
Bulletin—AT

Good CO_2?

"CO_2 readings show that on an average day our CO_2 varies between 13% and 14% despite load fluctuations."

Sunshine Biscuits, Inc.
Bulletin—SB

Increased efficiency?

"Operating efficiency has been as high as 82%—much of the credit going to the accuracy of (Hays) automatically controlled combustion."

Sherwin Williams, Chicago Plant
Bulletin—SW

Fuel savings?

"we estimated that...we would be able to pay for the new equipment (Hays Combustion Control) out of fuel savings in three years. Since then, the records show that the amortization of the original investment has been accelerated."

Raybestos—Manhattan, Inc.
Bulletin—RM

Rapid response to wide load swings?

"we have made test runs using the Hays system, bringing the load rapidly up from 8,000 to 80,000 lbs per hour with excellent results. Fuel-air ratio was held at the desired value and CO_2 at 15%."

Bemis Brothers Bag Company
Bulletin—BB

Bulletin—AT

Bulletin—SB

Bulletin—SW

Bulletin—RM

Bulletin—BB

THE **HAYS** CORPORATION *MICHIGAN CITY 3, INDIANA* • Automatic Combustion Control

Boiler Panels • Hays-Penn Flowmeters • Varidraw Meters and Veritrol • Gas Analyzers • Draft Gages • Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

GARLOCK METAL FOIL PACKINGS

GARLOCK Metal Foil Packings are specially designed for service on rods or shafts of equipment operating at high speeds and high temperatures.

They are constructed of thin metal foil spirally wrapped around a fibrous center core. Thus, the durability of metal wearing surfaces is combined with the resiliency of a fibrous packing.

The packings described at the right have a patented, pleated foil construction which makes them remarkably flexible and permits the forming of rings without undue distortion of the material. Also, the many small pockets in the pleats of the foil carry lubricant to the wearing surfaces of the packing. Write for descriptive folder.

COPPER GARLOCK 906—Pleated copper foil with asbestos core for steam, air or gases (except ammonia) and hot oils of low sulphur content, at temperatures up to 1000° F.

ALUMINUM GARLOCK 913—Pleated aluminum foil with asbestos core for hot oils at temperatures up to 1000° F.

LEAD GARLOCK 917—Pleated lead foil with asbestos core for steam, air, oil, water, ammonia or other gases at temperatures up to 550° F.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

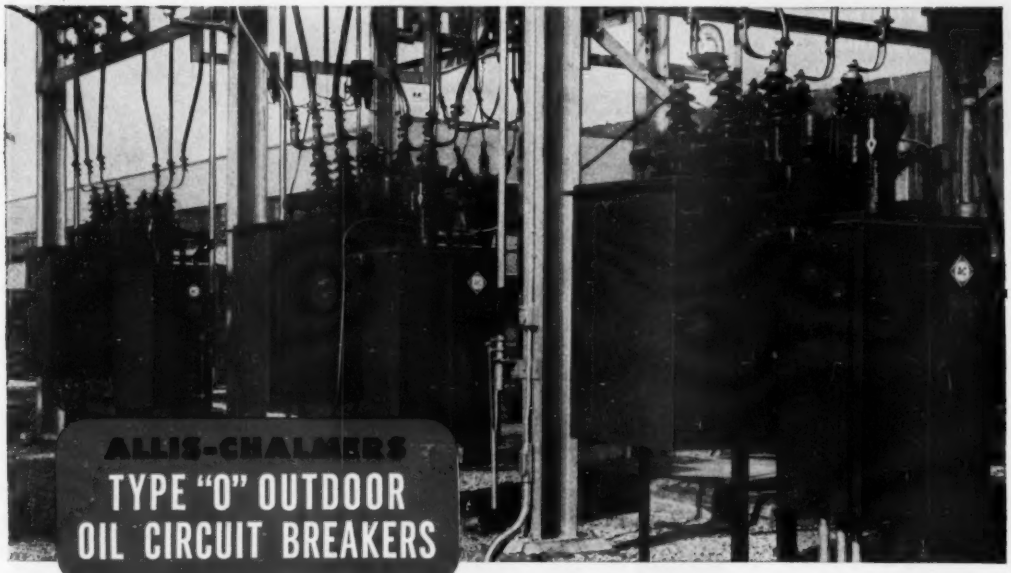
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK PACKINGS, GASKETS AND OIL SEALS

Dependable

ELECTRICAL PROTECTION

FOR DISTRIBUTION SYSTEMS



Packaged complete for improved automatic reclosing service

ALL YOU NEED to order your type "O" breaker is one set of specifications. It's simple and convenient. This standard 3-pole breaker comes to you mounted on a strong lightweight framework with operating mechanism and automatic reclosing equipment each in its own weatherproof housing. The type "O" breaker is factory assembled, wired and tested in accordance with ASA standards . . . ready to install and operate.

SECURE THESE PROVEN ADVANTAGES

1. **Positive, high speed breaker action with mechanically and electrically trip-free solenoid operating mechanism, ac or dc operation as specified.**
2. **Efficient circuit interruption with high rate of dielectric recovery for low contact and oil deterioration.**
3. **Automatic reclosing duty for unattended stations with standard protective and reclosing relay equipment included.**

Feature for feature you cannot buy better breakers in this class. Over 50 years of Allis-Chalmers progress in power circuit breakers is built into them. You can install them with complete confidence. For more information call your local A-C sales office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for bulletins 71B6165A (OX-18) or 71B6093C (OZ-110, OZ-210).

A-3440

Type	Rated KV	Rated Amps. (60 cycle)	Interrupting Capacity KVA
OX-18	7.2	600	50,000
OZ-110	14.4	600	100,000
OZ-210	14.4	600	250,000
OZ-210	14.4	1200	250,000
OZ-210	23	600	250,000

ALLIS-CHALMERS

NOW 3 GREAT PIPE INSULATIONS

Amocel

joins Unibestos in the UNARCO line of asbestos pipe insulations

...up to 650°F.

Answering the demand for a jacketed pipe insulation for use in the lower heat ranges, UNARCO now offers Amocel — for temperatures up to 650°F. Like Unibestos, Amocel is made of Amosite asbestos fibers bonded with an inorganic binder. For pipe sizes from ½" through 12", in Standard thickness only. Light in weight. Highly efficient. Durable.

UNIBESTOS
...up to 750°F.
UNIBESTOS
...up to 1200°F.

2 GREAT PIPE INSULATIONS — Unibestos No. 750 and No. 1200 — long have been America's outstanding insulations in their respective temperature ranges. Regular production for pipe sizes from ½" through 24" in popular thicknesses through 4". Other thicknesses and sizes available on order.

We want you to have our Catalog — It gives you complete information on Amocel and Unibestos Pipe Insulations; Unibestos Insulating Block; Cements and Finishes; Flexible Insulations; Metal Mesh Blankets; Tailored-to-Fit Insulations; Asbestos Packings and Gaskets; Asbestos Textile Products . . . Just drop us a line today requesting that we send you UNARCO Catalog No. 76-109.

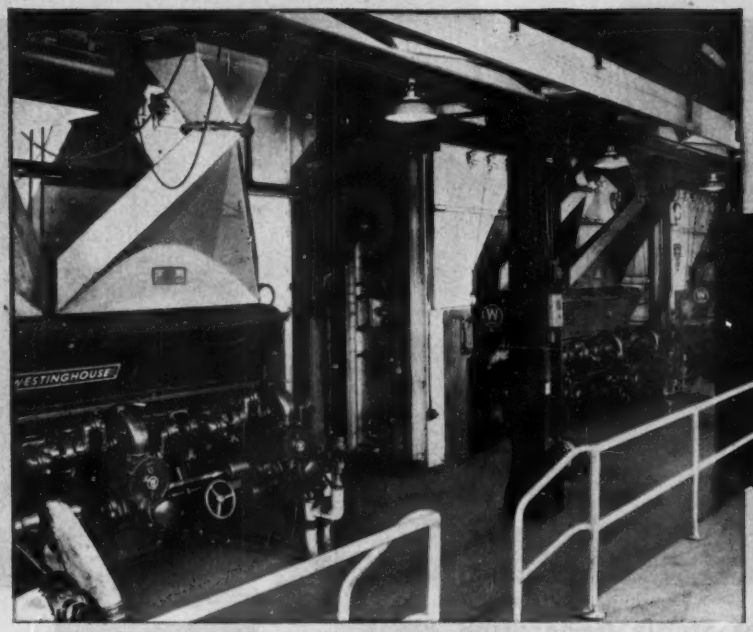
UNARCO

UNION ASBESTOS & RUBBER COMPANY

DEPT. 1819 • 332 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



The chief engineer of the Bellefield Boiler Plant, Pittsburgh, Pa. checks instruments at panelboard in front of 3 Westinghouse Multiple-Retort Underfeed Stokers with Link-Grate. This modern, central heating station serves Carnegie Library and Museum, the Cathedral of Learning and the entire Pitt Campus, the Mellon Research Institute, the YMHA and four large hospitals.

14 YEARS' DEPENDABLE OPERATION...

MAINTENANCE COSTS only 1¾ cents per ton

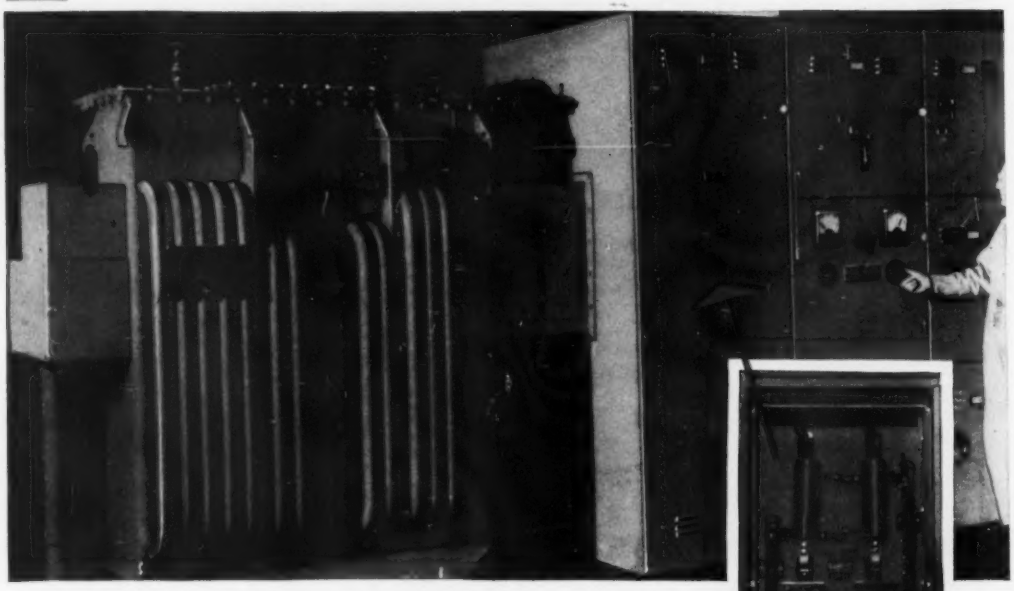
Accurate records at the Bellefield Boiler Plant prove this outstanding economy story. Stoker maintenance costs for 14 years, totaled only $4,275 for 240,000 tons of coal consumed for an average cost of only 1¾ cents per ton of coal.

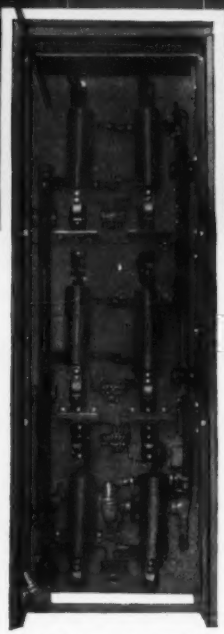
Maintenance economy like this is definitely a bonus beyond the exacting demands of continuous service . . . for RELIABILITY and CLEAN STACKS must be the prime consideration of plant management in serving a large group of public buildings. Only recently, another Westinghouse SDL Stoker was added to complete a battery of 3 Multiple-Retort Underfeed Stokers with Link-Grate that operate on a variable heating load of from 15,000 to 75,000 lbs. of steam per hour per boiler.

Westinghouse Stokers can give you these major operating advantages: Reliability, Flexibility, Lower Operating and Maintenance Costs. In addition you get the immediate attention of our Stoker Engineers for any of your heating, process, and power problems. Write today, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-50519

Westinghouse STOKERS

Now, St. Paul Foundry & Mfg. Co. buys all its power; saves $25,000 annually!





Costly, Inefficient Steam Generating Plant Replaced by

D-C UNIT SUBSTATION

Boiler capacity for cold weather heating is all that the St. Paul (Minn.) Foundry and Mfg. Co. retains of its former steam-driven d-c generating plant. By using purchased power, the company saves $25,000 annually in fuel, operating, and maintenance costs.

Purchased power is a-c, but the plant requires d-c power for yard cranes and hoists. To tie these two systems together, a six-tube G-E sealed ignitron rectifier was installed. It operates 24 hours a day, 7 days a week.

General Electric d-c unit substations with modern sealed ignitron rectifiers occupy minimum space. The transformer, rectifier and low-voltage switchgear are supplied as a complete, metal-enclosed, packaged unit. Absence of exposed, energized parts provides maximum protection to personnel. For information on d-c unit substations to fit your d-c power needs, call or write your nearest G-E sales office. General Electric Company, Schenectady 5, N. Y.

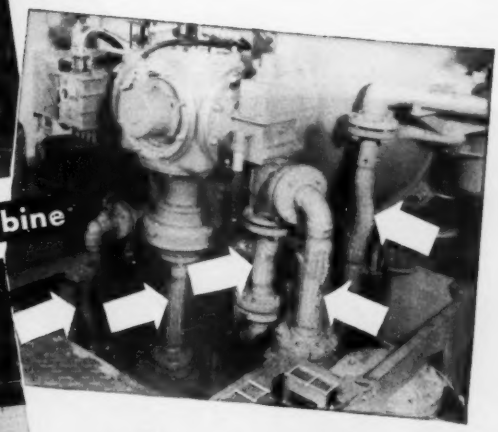
This photo shows the simple, compact design of the G-E ignitron mercury-arc rectifier unit. No major moving parts to wear out. No bearings or brushes to check. No vacuum pump required.

GENERAL ELECTRIC

324-4

Let CMH FLEXIBLE METAL HOSE

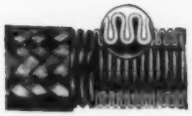
take the motion . . .



and your equipment *will last longer!*

In all types of connections subject to vibration, misalignment, flexation or expansion and contraction, CMH Flexible Metal Hose will solve the problem economically and dependably . . . and in most cases, it will simplify piping hook-ups and make them easier to assemble and dissemble. Your equipment will last longer, too, if CMH Flexible Metal Hose is used to absorb the damaging effects of motion in rigid assemblies or to relieve the stresses of misalignment.

There is a CMH hose type or standard assembly to meet virtually every need. CMH distributors, located in principal cities, will be pleased to give you full information . . . see your classified telephone directory or write for literature.



REX-WELD corrugated steel and bronze hose is available in standard sizes from ¾" through 12" I.D. for burst pressures to 12,000 psi, temperatures to 1000° F. Stainless steel types also available.

REX-TUBE convoluted hose is available in a variety of types including square locked, ball bearing and fully interlocked in a variety of metals including steel, bronze and other alloys.

Flexon identifies CMH products that have served industry for over 49 years.

CHICAGO METAL HOSE Corporation

1301 S. Third Ave. • Maywood, Ill. • Plants at Maywood, Elgin, Rock Falls, and Savanna, Ill.
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CMH

ONE DEPENDABLE SOURCE
for every flexible metal hose requirement

Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems
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one **Infilco** *installation treats both boiler feedwater and pulp mill supply*

This modern 64,000 ton mill at Fernandina, Fla., using deep well water, successfully treats both boiler feed and process water with a 2.2 mgd Accelator® followed by Zeolite softening.

RAW WATER FROM WELLS	INFILCO-POLISHED
HIGH in dissolved minerals, alkalinity, magnesium and calcium hardness	ZERO hardness
APPRECIABLE iron and color	ZERO iron and color
LARGE AMOUNT of silica present	LOW alkalinity and silica

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* BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE 1894 *

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World's Leading Manufacturers of Water Conditioning and Waste-Treating Equipment

Power
COMBINED WITH OPERATING ENGINEER

Oil Supplies Threatened

OUR CONTEMPORARY, *Coal Age*, a magazine devoted to the business problems and production techniques of the coal industry, warns that America's oil supplies are in danger and concludes that the situation calls for a strong swing toward coal.

This is one of those rare cases, says Editor Ivan Given, where "the paramount national interest dovetails perfectly and urgently with the best interests of an industry." He continues:

"To safeguard the national interest and foster future peacetime progress, development of a realistic fuels policy is a necessity—not at some future date, but now. Such a policy must favor coal—certainly in the industrial field, to a considerable extent in the space-heating field, in addition to those fields where coal is solidly entrenched. That already is foreshadowed by the recent Munitions Board directive to the military services that coal be given preference wherever possible.

"The reason is not hard to find. Consumption of oil and natural gas, compared to reserves and productive capacity, is far out of balance. That unbalance is increasing, and is bringing in its train growing dependence on oil imports and on long natural-gas pipelines. Consequently the day is at hand when all-out war, an interruption of oil imports, or other emergency, could leave the United States in a most critical position.

"The solution is a fuels policy that will insure that each fuel will be used for the purpose for which it is best suited. On this basis coal is the only answer for many applications where oil and natural gas are now being used—steam raising and space heating, for example, along with many others.

"The United States is far out on a limb in its growing dependence on liquid and gaseous fuels. The hazard, therefore, is immediate, and with it the need for action."

These editorial observations reflect an awareness of the business needs of the coal industry. They will be used as sales arguments to promote coal in competition with oil.

Yet if we study them critically from the viewpoint of power engineers who have no sales stake in any fuel we still must agree that the threat is real and that prudent engineers should consider it as one more factor in balancing the advantages of the several fuels. Of course, how much shifting to coal is worthwhile will depend a lot on location. In some parts of the United States oil (or gas) is the "natural" and economical fuel. Plant owners in such spots won't be swinging to coal in a hurry.

But there's no blinking the fact that the situation cited by *Coal Age* is another factor favoring coal where coal and oil are nearly in economic balance.

Finally, we see here one more argument for fuel versatility. Many an installation being planned today should be designed to burn more than one fuel. Why risk fuel shortages or excessive prices?

Select Your Steel Valves

Edward GAGE VALVES 600 lb sp

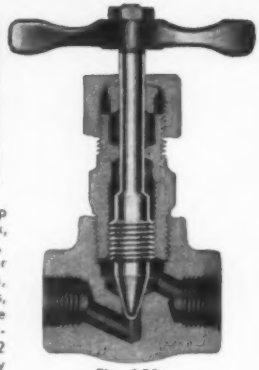


Fig. 152

FIG. 152 SERIES—A drop forged, instead of bar stock, steel valve for gage, meter, dead-end, instrument and other small lines, and for pumps, vents, Diesel and gas engines, etc. Long taper semi-needle type stem-disk for close regulation and tight seating. Fig. 152 series has carbon steel body with EValloy 13% chrome stem-disk. Fig. 2152 series, all 13% chromium stainless steel. Fig. 4152 series, all 18-8 stainless steel.

Screwed Ends—Globe or Angle

Size Range—⅛", ¼", ⅜", ½", ¾" and 1"

Edward INSTRUMENT VALVES 1500 lb sp

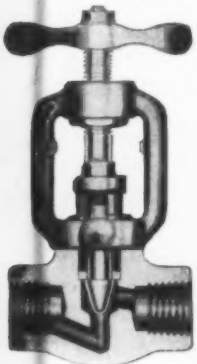


Fig. 952

FIG. 952 SERIES—A compact, heavy-duty valve for instrument panels, regulators, orifice meters, by-pass lines, oil field gage or instrument services, corrosive lines, etc. Drop forged steel body and yoke. No possibility of bonnet joint leakage. Swing bolted gland. Fig. 952 series valves have carbon steel body with EValloy 13% chromium stainless steel trim. Fig. 2952 series has EValloy stainless steel body and trim.

Screwed or Socket Welding Ends—O. S. & Y.—Globe or Angle

Size Range—¼", ⅜", ½"

Edward Globe & Angle Valves 600-1500 lb sp

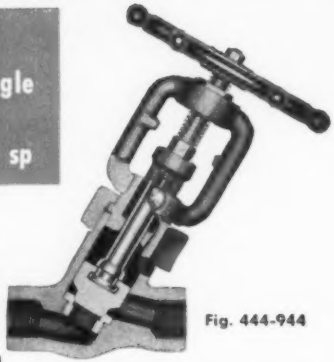


Fig. 444-944

FIG. 444-944 SERIES—All purpose valves, ideal for nearly any service where O. S. & Y. small forged steel valves are used. Streamlined, low-pressure loss body and bonnet both forged steel. Built with union bonnet in sizes 1" and smaller for 600 lb sp, and in sizes ¾" and smaller for 1500 lb sp. Larger sizes in both pressure classes have bolted bonnet joint. Bronze bushed yoke, simplified bolted gland design for easy packing adjustment, EValpak high pressure-high temperature die-molded packing, and inclined stem design for free flow and minimized turbulence are standard features. Easy to repack, with both hands free to insert packing. Stem, disk and seat hardened EValloy 13% chromium stainless steel regularly furnished; Stellite hard-faced seat and disk available on order.

Fig. 448-948

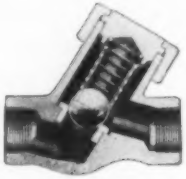
Screwed or Socket Welding Ends—O. S. & Y. —Globe or Angle

Size Range—¼", ⅜", ½", ¾", 1", 1¼", 1½" and 2"

Edward CHECK VALVES 600-1500 lb sp

WIDE CHOICE

Edward forged steel check valves are built in ball or piston types, with union or bolted bonnets, with screwed, socket welding or flanged ends. Available for installation in either horizontal or vertical lines.

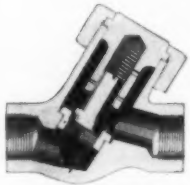


BALL CHECKS

Ideal for viscous fluid service. Spring loaded, fully guided ball disk is stainless steel, as is the mated seat.

Screwed or Socket Welding Ends—Horizontal or Vertical.

Size Range—¼", ⅜", ½", ¾", 1", 1¼", 1½" and 2".

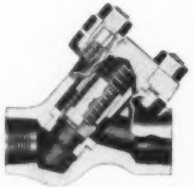


PISTON CHECKS

General service small check valves that give freedom from shock or excessive vibration, yet seat quickly and tightly upon flow reversal.

Screwed, Socket Welding or Flanged Ends—Horizontal or Vertical.

Size Range—¼", ⅜", ½", ¾", 1", 1¼", 1½" and 2".



BOLTED COVER CHECKS

Either ball or piston types, in variations of body style and end connections for boiler feedline or general process services.

Screwed, Socket Welding or Flanged Ends—Horizontal, Vertical or Angle.

Size Range—½", ¾", 1", 1¼", 1½" and 2".

From New Edward Designs

These are among the many new Edward designs. The Edward steel valve line is never static. From a development department devoting its time exclusively to the problems of temperature, pressure and other operating conditions usually associated with the use of steel valves, have come—through the years—literally hundreds of design and material innovations. Many Edward features have become industry standards; others are still exclusive with Edward. The new designs described briefly here are ideally suited for the service conditions of today's power plant, petroleum, industrial and technological installations.

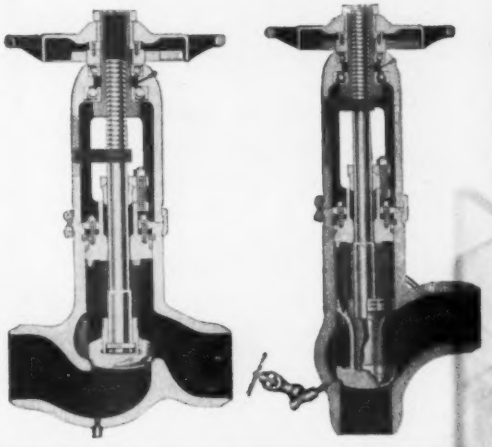
Fig. 2224

Edward
Welded Bonnet UNIVALVES
1500 - 2500 lb sp

FIG. 2224 SERIES—Welded bonnet, inclined stem forged steel globe valves. Integral Stellited seat and disk construction, perfect alignment between body and bonnet, contoured for least resistance to flow and to cut wear-producing erosion. Bonnet joint leakage forever eliminated. Forged chromium-molybdenum bodies. Impactor handle available on larger sizes. Fig. 2224 series for 1500 lb service; Fig. 3924 for 2500 lb sp.

Socket Welding Ends—Globe Type

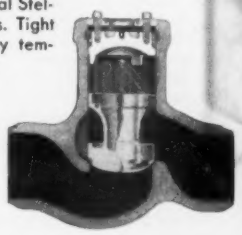
Size Range—½", ¾", 1¼", 1½" and 2"



Cast Steel Pressure-Seal Valves

900-1500-2500 lb sp

GLOBE AND ANGLE STOP, NON-RETURNS, CHECKS—Newest design pressure-seal bonnet valves in globe or angle stop or non-return and horizontal or angle check valves. Many features are Edward "firsts"—Impactor handwheels, EValthrust yoke bushings, Equalizers, streamlined flow passages, etc. Regularly built with integral Stellited seats and Stellited disks. Tight bonnet-joint connection at any temperature, low maintenance, easy disassembly, proven materials for top temperatures and reduced weight are among the features. All types in either 900, 1500 or 2500 lb sp classes.



Size Range—2½, 3", 4", 6", 8", 10", 12" and 14".

Edward
BLOW-OFF VALVES
300-600 1500 lb sp

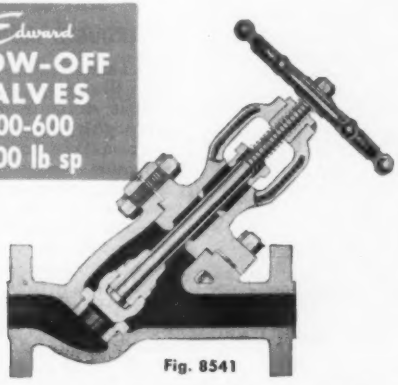


Fig. 8541

FULL RANGE—Edward cast and forged steel blow-off valves, in straightway or angle patterns, meet all standards for blow-off valve service, and give complete flexibility in working piping hook-ups for any space limitation. Slow-opening type so that damaging shock to piping is eliminated.

Flanged or Socket Welding Ends — Straightway or Angle

Size Range—1½", 2" and 2½".

For more data on these or other valves in the complete Edward steel valve line, write for Catalog 104. Or, if you indicate special interests in valves or various types, we can include special bulletins you will find helpful.

Another Product

Edward Valves, Inc.

Subsidiary of **ROCKWELL MANUFACTURING COMPANY**

1220 WEST 144th STREET

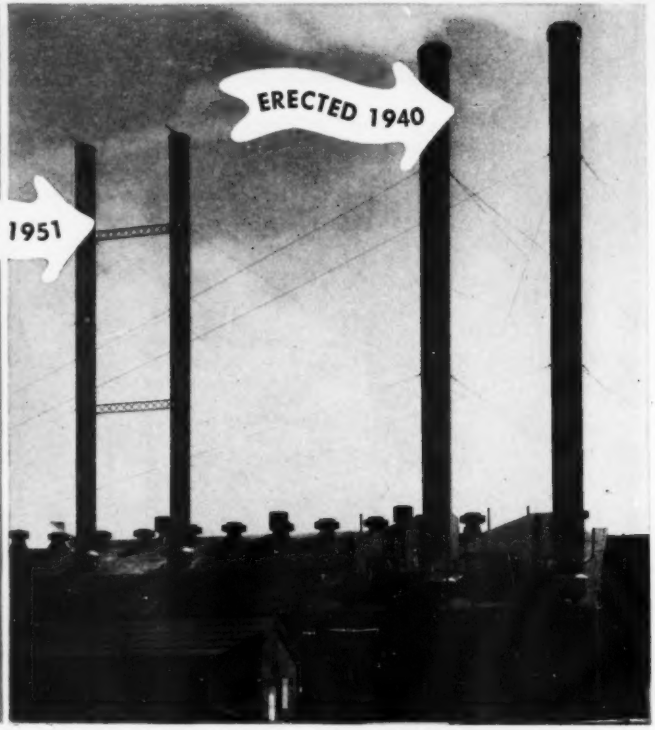
EAST CHICAGO, INDIANA

You don't have to look far

ERECTED 1951

for the reasons why they used

BYERS WROUGHT IRON



When engineers of the Morton Salt Company, Rittman, Ohio, made plans recently to erect two new stacks, they had the finest guide for selecting a durable material that anyone could ask—two genuine wrought iron stacks installed by the company in 1940 and still in excellent condition.

Basing the specifications for the new stacks on the service records of the old, the engineers selected genuine wrought iron. The new stacks, 5-feet, 6-inches by 140-feet, were fabricated from $\frac{5}{16}$ and ¼-inch Byers Wrought Iron plate by the Dover Tank and Plate Company.

Unlined metal stacks face severe corrosive conditions. Carbon dioxide is always present as a combustion product, and some sulfur compounds are generally encountered. When these are dissolved in condensed moisture, a dilute acid is formed which causes severe damage to vulnerable metals. Even when initial conditions are not severe, foresight suggests the use of durable material. For the aggressiveness of attack may be aggravated at any time, by the change of fuel, by the use of economizers or steam-jet draft inducers, or by intermittent operation.

Byers Wrought Iron is a veteran in stack service, and engineering records provide convincing evidence of its superior durability. How the unique character of this material is helping others combat flue gas corrosion is explained in our bulletin, WROUGHT IRON FOR FLUE GAS CONDUCTORS AND COAL HANDLING EQUIPMENT. It may help you . . . so write for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.

WHY GENUINE WROUGHT IRON LASTS

This notch-fracture test specimen illustrates the unique fibrous structure of genuine wrought iron—which is responsible for the high corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

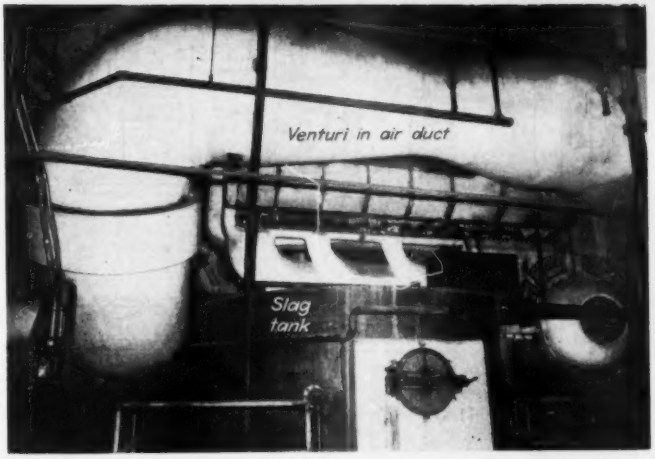
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Cyclones . . .

. . . 2 per boiler, generate 375,000 lb steam per hr at 1325 psig and 960 F

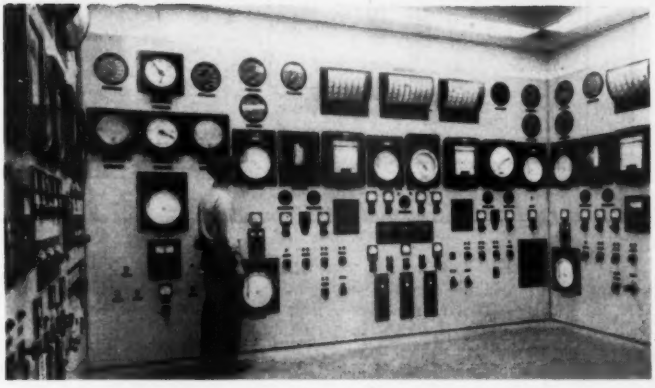
burn 2 fuels . . .

. . . together or separately in each cyclone in desired proportions



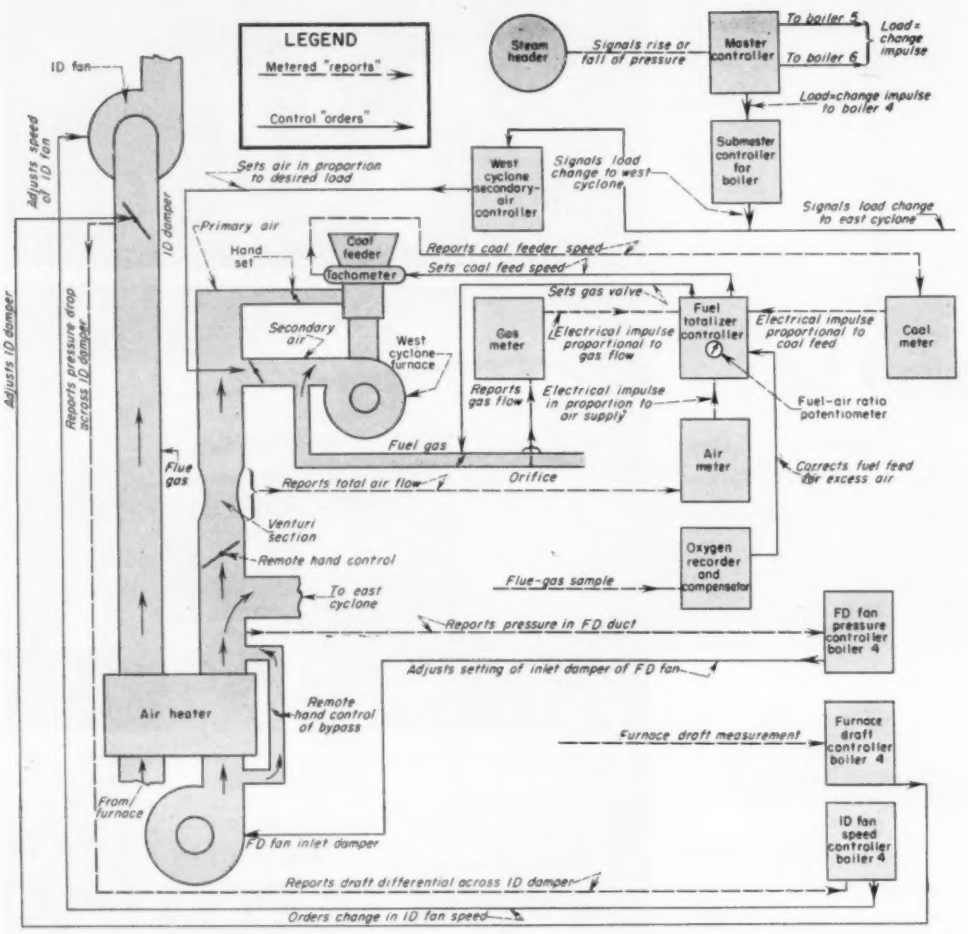
automatically . . .

. . . by flexible system permitting any desired allocation among boilers, furnaces and fuels . . .



. . . at Michigan City Station, Northern Indiana Public Service Co; system sets air flow for load, matches Btu of combined fuels to air, corrects fuel input by oxygen recorder

COMBUSTION CONTROL SYSTEM . . .



► EVER SINCE its initial operation in 1931, the Michigan City (Indiana) Generating Station of the Northern Indiana Public Service Co has been noted for the dignity of its functional architecture and the beauty of its location on the sand dunes at the south end of Lake Michigan.

The current major enlargement makes this plant important also as an example of advanced engineering design, particularly in the use of two fuels, coal and gas, burned simultaneously in cyclone furnaces under full automatic control. This article is concerned primarily with the control system, particularly as it applies to the boiler units and their cyclone furnaces.

The original Michigan City Station totaled only 68,000 kw in a single turbine (650 psig and 750 F) served by three pulverized-fuel-fired boilers. The original building, however, left room for the present addition, which totals 140,000 kw. The first 70,000-kw unit started operation Oct 23, 1950. The second should be running by November 1951.

Cyclone Furnaces. Operating at 1250 psig and 950 F, the new turbines take steam from three boilers, each with a continuous capacity of 375,000 lb per hr. As already indicated, each boiler is fired by two cyclone furnaces, the cyclones burning crushed coal ¼ in. and under. Gas will be burned on weekends during summer months when surpluses of gas are available.

Cyclone furnaces, first tried out commercially at a Commonwealth Edison station in 1944, are now producing steam in a substantial number of utility and industrial plants. For a recent example see detailed description of Dow Chemical's installation at Midland,

. . . WORKS THIS WAY

CHANGE IN STEAM-HEADER PRESSURE SIGNALS MASTER CONTROLLER . . .

. . . to increase or decrease steaming rate of en ire new section of station (Boilers 4, 5, 6)

MASTER TRANSMITS IMPULSE TO THREE SUBMASTERS . . .

. . . for Boilers 4, 5, 6, calling for increase or decrease of combustion rate.

Any desired boiler may be set on fixed load. Remaining boilers may be preset by biasing potentiometers (on boiler-control panels) to split remaining load equally, or unequally, but proportionally

SUBMASTER 4, SAY, THEN TRANSMITS IMPULSE CONTROLLING THE SECONDARY-AIR DAMPERS . . .

. . . on East and West cyclone furnaces of Boiler 4. Here again one of cyclones may be set on fixed load. Or potentiometers (on one boiler-control panel) may be set for equal or proportional loading. Whatever the division (under automatic control), submaster insures total air flow directly proportionate to load Boiler 4 must carry. This holds for any fuel and any combination of fuels

FUEL TO GIVEN CYCLONE IS THEN PROPORTIONED TO ITS AIR FLOW . . .

. . . by converting air flow, gas flow, coal flow to electrical voltages. Values for coal and gas (converted to common Btu basis) are electrically added and balanced against air value. So total fuel is correct regardless of division, which may be according to any preset plan.

Air is metered at venturi section in f-d duct to each cyclone.

Coal feed ties in through blower-type tachometer. Orifice pressure drop measures gas flow. In each case a pressure (or pressure difference) is translated into voltage. Potentiometer hookup in totalizer totals fuel, and balances the sum against air flow. Another potentiometer setting permits varying fuel-air ratio of individual cyclone. This, in turn, is automatically corrected by oxygen analysis for precise control of excess air

PRIMARY AIR DAMPER IS ADJUSTED . . .

. . . by hand. And then it is left at that setting

INDIVIDUAL CYCLONE F-D DAMPERS ARE HAND CONTROLLED . . .

. . . from switches on the panel operating power units at the dampers

F-D DUCT PRESSURE CONTROLLER MAINTAINS PRESSURE "ORDERED" BY THE SUBMASTER . . .

. . . as suitable for assigned load. F-d duct pressure controller adjusts f-d fan inlet damper, through power unit, until desired duct pressure is reached

I-D DAMPER CONTROLS FURNACE DRAFT, WHILE I-D FAN SPEED IS CONTROLLED TO MAINTAIN CONSTANT-PRESSURE DROP ACROSS DAMPER . . .

First, furnace draft operates power unit on i-d damper to give proper draft. Any change of damper differential from normal actuates control, which works oil pump on i-d fan hydraulic coupling to adjust fan speed, restore differential

AIR-BYPASS DAMPER HAND CONTROLLED . . .

. . . by switches on the panel through the power unit at the damper

MANY INTERLOCKS PROVIDED

Whole system, or any part of it, may be placed under hand control in the proper sequence. An elaborate system of interlocks forestalls any attempts to operate with unworkable or unsafe sequences or combinations

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Michigan, August 1950 issue of POWER.

Briefly reviewing descriptions previously published, of this novel combustion system, the cyclone furnace is a watercooled cylinder lined with refractory chrome ore. Satisfactory operation requires that a coating of slag be maintained on the inside of the cyclone.

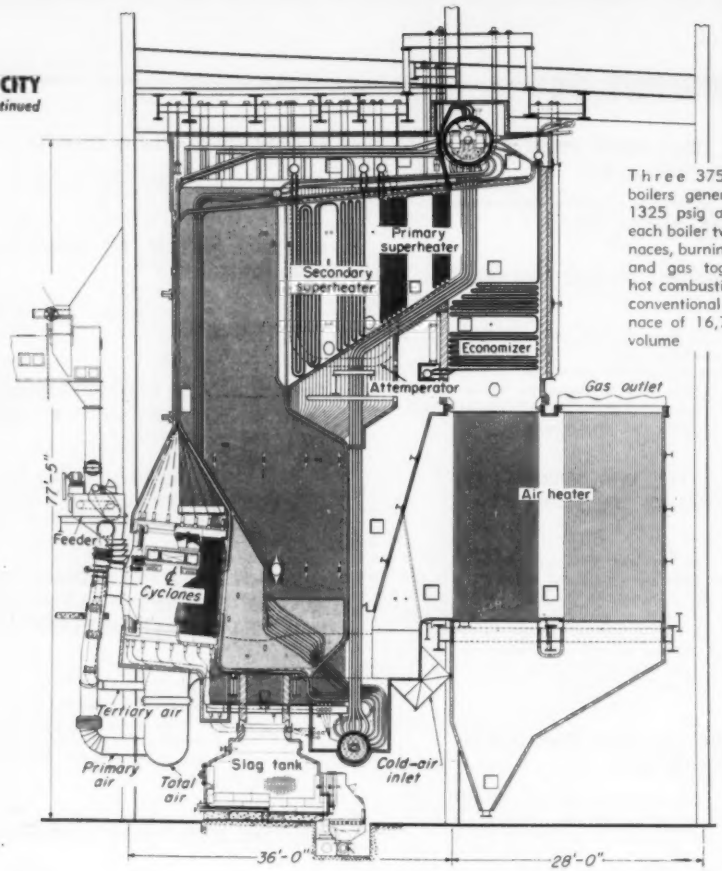
Coal, crushed to pass through a No. 4 screen, is fed tangentially to a primary burner along with a small amount of combustion air. Secondary air (the main combustion supply) is introduced tangentially and at high velocity at the full diameter of the cyclone furnace.

Surrounded by a film of hot molten slag, the whirling mixture of air and fuel particles burns at the very high rate of 500,000 Btu per cu ft per hr. Most of the coal's ash is trapped in the slag film and combustion is practically complete when the gases leave the watercooled outlet nozzle of the cyclone furnace to enter the conventional radiant furnace. Slag drains from the discharge end of the cyclone to the bottom of the primary furnace and from there, through a continuous slag tap opening, to a water-filled slag tank.

The cyclone furnace is designed to trap most of the coal's ash in the molten slag film, thus greatly reducing discharge of dust to stack. Another aim is to eliminate the cost of coal pulverizing and to allow use of high-ash low-rank coals.

Flexible Controls. Michigan City is one of the first plants to provide for the burning of coal and gas simultaneously in the same cyclones under full automatic control.

The ingenious combustion-control system permits any desired allocation of load among the three boilers. It



Three 375,000-lb-per-hr boilers generate steam at 1325 psig and 960 F. In each boiler two cyclone furnaces, burning crushed coal and gas together, deliver hot combustion products to conventional radiant furnace of 16,740 cubic-foot volume

also makes possible any desired division of load between the two cyclones of a given boiler and between the two fuels being burned simultaneously in a given cyclone.

For example, all three boilers may be loaded equally or proportionally. Again, one or two boilers may be set for fixed loads, while the others carry load variations with equal or proportionate loading.

Finally, after a given load is assigned to a given cyclone, there still remains full freedom of choice as to fuel combination: (1) all one fuel (2) one fuel fixed, while the other varies (3) gas to limit of supply with coal automatically supplementing gas required.

The load to be carried by any cyclone is first established by setting or controlling its air flow. Next its total fuel Btu input is matched to the air flow.

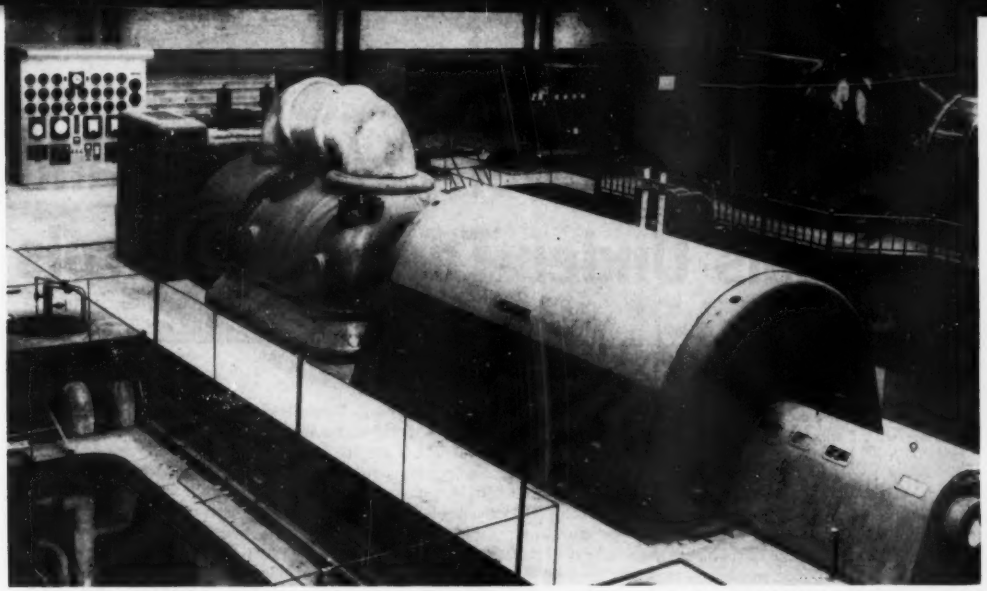
This method of control is ingenious. Differential pressures created by the flow of air through a venturi section, flow of fuel gas through an orifice, and flow of coal, measured by a tachometer, are measured and converted to voltages on potentiometers. Then, "coal volts" are added to "gas volts" and balanced (by means of a bridge circuit) against "air volts."

Novel Features. This Michigan City installation has other novel features, one being the use of an oxygen recorder to permit close adjustment of excess air. Another is the use of a limiting controller to automatically reduce the fuel and air input to amounts that can be handled with safe furnace pressure conditions, if a partial or temporary loss of induced draft occurs. This controller functions under either automatic or manual control conditions. The boiler control panel includes a Diamond Utiliscope, which televises a view of the water column to the boiler operator.

The various controllers, shown diagrammatically on page 72, operate dampers, and the other final mechanical elements of control, by sending "characterized" electrical impulses to "power units." For all heavy operations the power units are motor-driven with self-locking double-worm reduction gears, built-in limit switches and reversing relays. Handwheels are provided for direct manual operation.

Each power unit is equipped with a panel-mounted selector, a manual control switch and an electrical position indicator to permit manual operation from the central control room. Switches are mechanically interlocked and are equipped with pilot lights to insure a definite sequence of operations in transferring from "hand" to "automatic" control.

Control system at the Michigan City Station was furnished by the Hays Corp, with the exception of the oxygen recorder. The cyclone-fired boilers were supplied by Babcock & Wilcox, and the oxygen recorder by Bailey Meter Co. Consulting engineers were Sargent and Lundy.



First 70,000-kw, 3600-rpm turbine takes steam at 1250 psig and 950 F, and exhausts at 1.5 inch mercury after 5 bleed points. Generator (81,176 kva and 86% pf) is hydrogen cooled. Duplicate unit will soon be installed in space at left

PRINCIPAL POWER-PLANT EQUIPMENT

Units 2 and 3, Michigan City Generating Station, Northern Indiana Public Service Co

STEAM GENERATING EQUIPMENT:

Boilers, 3 ..... Babcock & Wilcox Co
Radiant type, 2 cyclone furnaces per boiler, 375,000-lb-per-hr 1325-psig 960-F steam, 16,740-cu-ft furnace; 9818-sq-ft boiler and furnace surface
Superheaters, 3 ..... Babcock & Wilcox Co
Pendant, continuous tube, 17,000 sq ft, attemperator control
Economizers, 3 ..... Babcock & Wilcox Co
Continuous tube, 94,000 sq ft
Air heaters, 3 ..... Babcock & Wilcox Co
Tubular, two sections, 85,000 sq ft
Boiler feedwater control ..... Northern Equipment Div, Continental Foundry & Machine Co
Forced-draft fans, 3 ..... Ingersoll-Rand Co
120,000 cfm, 54-in. water head, 1500-hp motor drive, 1800 rpm inlet-damper control
Induced-draft-fans, 3 ..... American Blower Corp
157,000 cfm, 13.3-in.-water head, 900-hp 720-rpm motor drive, hydraulic coupling, 2¾% maximum slip
Dust collectors, 3 ..... Western Precipitation Corp
Coal scales, six, 15-ton-per-hr ..... Richardson Scale Co
Coal crushers, 2 ..... Pennsylvania Crusher Co
Reversible, ¼-in. coal, 350-hp motor drive
Coal-conveying equipment ..... Stephens-Adamson Mfg Co
Revolving-car dumper ..... Wellman Engineering Co

POWER GENERATING EQUIPMENT:

Turbine-generators, 2 ..... Westinghouse Electric Corp
Tandem compound, 70,015 kw, 3600 rpm, 1250 psig, 950 F, 1-5-in. Hg exhaust, 5 bleed points, 81,176 kva, 86% pf, hydrogen cooled, main and pilot exciters
Condensers, 2 ..... Ingersoll-Rand Co
42,500-sq-ft surface, single pass, divided waterbox 7135 ⅝-in. 18 BWG tubes, inhibited admiralty, 76,000-gpm circulating water
Steam-jet air ejectors ..... Ingersoll-Rand Co
Twin element, two-stage, admiralty tubes, 690-lb-per-hr steam
Condensate pumps, 4 ..... Ingersoll-Rand Co
3-stage, 1000-gpm, 350-ft dynamic head, 150-hp 1200-rpm motor drive
Circulating-water pumps (No. 2) Worthington Pump & Machinery Corp
Two, single-stage volute, 38,000 gpm, 16-ft total head, 200-hp 252-rpm motor hrive
Circulating-water pumps (No. 3) 2 ..... Ingersoll-Rand Co
Single-stage vertical, mixed flow, 40,000 gpm, 15-ft total head, 200-hp 300-rpm motor drive

FEEDWATER EQUIPMENT:

L-p heaters, 2 ..... American Locomotive Co
360,000-lb-per-hr water, 81 to 165 F, 30,600-lb-per-hr 6.05-psia steam, 4 passes, 2380 sq ft, 376 admiralty tubes
415,000-lb-per-hr water, 166 to 224 F, 25,400-lb-per-hr 20.5-psia steam, 4 passes, 2380 sq ft, 376 admiralty tubes
Deaerating heaters, 2 ..... Elliott Co
Direct-contact, tray type, 550,000-lb-per-hr water, 75 psig, 368-sq-ft surface-area vent condenser
H-p heaters, 2 ..... American Locomotive Co
500,000-lb-per-hr water, 276 to 337 F, 28,600-lb-per-hr 128-psia steam, 2 passes, 1811 sq ft surface, 285 tubes of 80-20 copper-nickel
H-p heaters, 2 ..... American Locomotive Co
500,000-lb-per-hr water, 337 to 391 F, 28,000-lb-per-hr 247-psia steam, 2 passes, 1811-sq-ft surface, 211 tubes of 80-20 copper-nickel
Evaporators, 2 ..... Foster Wheeler Corp
20,000-lb-per-hr vapor, submerged coil, 668-sq-ft surface
Boiler feed pumps, 4 ..... Ingersoll-Rand Co
400,000 lb-per-hr, 8-stage, 1638-psi total head. One pump turbine driven, three pumps 1250-hp 3580-rpm motor drive
L-p heater drain pumps, 2 ..... Ingersoll-Rand Co
149 gpm, 2-stage, 425-ft net head, 30-hp 3600-rpm motor drive
Evaporator feedwater pumps, 2 ..... Ingersoll-Rand Co
1-stage, 80 gpm, 85-ft net head, 3-hp 3600-rpm motor drive

AUXILIARY EQUIPMENT:

Slag-handling equipment ..... United Conveyor Corp
One tank per boiler, 3 jet ash pumps, 1630-gpm h-p water, 210-gpm l-p water, 50-tons-per-hr capacity
Flyash-handling equipment ..... United Conveyor Corp
Mechanical, 15 tons per hr, 650-gpm water
Ash-sluicing pump ..... Ingersoll-Rand Co
2-stage 2000 gpm, 348-ft total head, 250-hp 1800-rpm motor drive
Service-water pump ..... Ingersoll-Rand Co
Single stage, double suction, 2000 gpm, 202-ft total head, 150-hp 1800-rpm motor drive
Bilge pumps, 4 ..... Yeomans Brothers Co
Water-filtering systems, 2 ..... Infilco Inc
Vertical press, 150 gpm, 100 psig
Traveling screens, 4 ..... Chain Belt Co
Vertical, 5-hp 900-rpm motor drive
Fish screen ..... Electric Fish Screen Co
Station air compressor ..... Joy Manufacturing Co
Two-cylinder 2-stage, 5½x3x5 in., 10-hp 1750-rpm motor drive
Combustion control system ..... Hays Corp

ELECTRICAL EQUIPMENT:

Main control boards } Relay and meter panels ..... Westinghouse Electric Corp
Switchgear, 500 v, 440 v ..... General Electric Co
Transformers, 7 ..... Allis Chalmers Manufacturing Co
25,000 kva, single phase
Transformers ..... General Electric Co
Three 3-phase 5000 kva, three 3-phase 300 kva
Auxiliary control centers, 5 ..... Westinghouse Electric Corp
Oil circuit breakers, 138-kv, 13 ..... General Electric Co, Westinghouse Electric Corp
CONSULTING ENGINEERS ..... Sargent & Lundy

How to Buy Power Equipment and Materials Under Today's Controls

To see how defense controls affect you, the power engineer, let's start with a quick look at the over-all picture.

THE BACKBONE: MATERIALS CONTROL

1 Why the emphasis on control of materials?

By and large, we have enough facilities for fabricating metals, but, for a while at least, we can't produce materials fast enough to hold the defense-production pace we need and keep the civilian economy running full. The *Controlled Materials Plan* (CMP), and related controls, aim at insuring that military needs, and then defense-supporting needs, are not delayed by lack of essential materials.

2 What are the controlled materials?

Steel, copper and aluminum, the metals most widely used in industry, are all in tight supply. Using them as the "controlled materials" not only insures *their* equitable distribution but also serves as a rough control on production in general and on use of other critical materials.

3 How does CMP work?

If you use steel, copper or aluminum, in construction or manufacturing anything from boilers to baby buggies, you come under CMP. In broad outline, the plan works this way: Users of steel, copper and aluminum file applications listing their requirements for a specified period. Totaled, these statements give the upcoming needs for the various forms of steel, copper and aluminum. These needs can be compared directly with estimates of the supply.

With such figures, mobilization authorities can divide available supply to best advantage, taking into account relative needs and urgencies. Depending on how the balance is struck, each group of users gets allotments for all or part of their needs. In a given period, for example, builders of military items may be assured 100% of their requirements, while builders of defense-supporting equipment may get 85%. And makers of baby buggies may get only 50%.

CMP IN OPERATION

4 What does a CMP allotment mean?

Except for small quantities and under certain limitations, no one can buy controlled materials from primary suppliers without a CMP allotment. The allotment thus becomes a sort of certified check for specified amounts of steel, copper and aluminum in "mill shapes"— plate, strip, rod, wire, etc. Each user with a CMP allotment may proceed with his scheduled production, assured that he'll get controlled materials up to the share assigned to him.

5 Is there any distinction between product types?

Under CMP, there are two main classes of products— "A" and "B." Let's take a look at "B" products first. These comprise most industrial and civilian items of more or less standard design. Virtually all units of power *equipment*— turbines, boilers ,diesels, pumps, compressors, motors, switchgear, etc.— are "B" products. So also are such familiar consumer products as electrical appliances, autos.

Manufacturers of "B" products file applications for the controlled materials needed for each quarter's scheduled production. They also state what percentage of their orders are "rated." As we'll see later, rated orders are those declared essential. If materials allotted to a manufacturer are insufficient to carry out all scheduled production, rated orders must be given preference.

6 Just what is an "A" product?

The line between "A" and "B" products isn't always easy to draw, but the general idea of an "A" product is one tailor-made to a single purchaser's specifications, and usable only by that purchaser. Virtually all weapons, for example, are "A" products, made to armed-forces specifications and usable only by them. In fact, the designation was first conceived and used for military items. In the power field, a boiler breeching made by a fabricator to the plant owner's design would be a typical "A" product.

Application for controlled materials in "A" products is made by the purchaser, not the fabricator. Requirements are presented for the quarter in which the fabricator must receive mill shipment in order to meet the customer's delivery date.

CONSTRUCTION MATERIALS UNDER CMP

7 How about items that are neither "A" nor "B"?

Almost any power-plant job needs some items that are neither "A" nor "B" products, but just *controlled materials*. Examples are reinforcing rod, pipe in mill form (not fabricated), metal tubing, etc. These are items bought in standard mill shapes; any cutting, bending or "fabricating" is done in the field by the ultimate user or his contractor.

Applications for such "direct-use" controlled materials are also made by the purchaser, just as for "A" products. Instead of turning the allotment over to a fabricator for *his* mill purchases, the ultimate user employs it directly.

8 Does the way an item is bought make a difference?

Whether a given item is an "A" or "B" product, or just controlled materials, depends to some extent on how it's purchased. A coal-conveying system, including needed structural steel, is a "B" product if bought as a unit. If, however, the manufacturer supplies only the conveying equipment and the plant owner buys the structural steel from a fabricator, the structural steel becomes an "A" product.

Condensers, for another example, are "B" products. If tubes are part of the contract, they become part of the "B" item, and condenser manufacturer applies for the allotment. If the plant owner decides to buy tubes separately, from a tubing supplier, the tubes become controlled materials, to be applied for by the plant owner.

- **If you've got power equipment on order now, or plan to purchase, you'll be affected by current wider and stronger controls**
- **How much you're affected depends on what you're buying, what you want it for, and when you need it**
- **How well you make out depends to a large extent on how clearly you understand the control system and work within its rules**
- **Here's the basis for such understanding—a broad, realistic picture, uncluttered by details that confuse (and change!)**

9 How does allotment procedure vary?

We've seen that for "B" products, manufacturers file applications for controlled materials and receive allotments. For "A" products and direct-use controlled materials, the purchaser files the application, gets allotment.

There is also a difference in *where* the application is filed. Manufacturers of "B" products file CMP applications with the National Production Authority (NPA) and all allotments for materials going into "B" products issue from NPA.

Allotments for controlled materials to be used directly by the purchaser or to be used in "A" products, come from so-called "claimant agencies," or, in certain cases, from NPA (more about that angle later). The claimant agencies also issue the "rating" mentioned before.

To see just what a claimant agency is, and how it fits into the picture, let's run through the CMP procedures for a power project. Let's use a utility project as an example because it makes a clear-cut case. Then, when we've got the outline of the setup clear, we can take a closer look at the angles for industrial and institutional plants.

HOW CMP AFFECTS A POWER JOB

10 What's the first step?

For our example, let's imagine that All-American Power Co engineers, after load-growth studies, decide their system needs a 40,000-kw addition to Big Watt Station, plus some transmission lines and feeders to tie-in the new capacity. They figure they need these by 1953. So All-American files a *project statement* with Defense Electric Power Administration (DEPA). This outlines their plans.

DEPA is the claimant agency for *electric utilities*. Broadly stated, DEPA's job is to see that the U.S. gets the power it needs, when it needs it, and gets it with minimum use of critical materials and facilities. And, having determined essential power-system expansion, it's their further job to defend the industry's needs when top mobilization authorities slice the materials "pie."

11 How does a power project get approved?

Various DEPA divisions scrutinize All-American proposed projects. Is the capacity really needed? Is it needed in 1953? Is extending Big Watt Station the most effective answer from the over-all mobilization angle? What is the job going to take in critical materials and equipment?

If DEPA is satisfied on all the above points, All-American's proposal becomes part of DEPA's program and is an "approved" project. This entitles All-American to apply a rating to its orders for equipment and material, so manufacturers and suppliers must give preference to them.

12 What happens to equipment orders?

All-American's project will need many items of equipment ("B" products), some fabricated items ("A" products) and some controlled materials in mill shapes to be used directly by the power company or its contractors.

Orders for "B" products are placed with manufacturers, each carrying a rating symbol to indicate priority. Manufacturers put these orders on their schedules. At the proper time, they'll include materials needed in their regular quarterly requirements applications.

Many power-equipment "B" products come under two of NPA's many "industry" divisions—Engine and Turbine Division (E&TD) and Electrical Equipment Division (EED). Some items having general industrial use come under other divisions: General Components (valves, bearings, etc), General Industrial Equipment (pumps, fans, compressors, etc), and Scientific and Technical Equipment (instruments, etc).

CONTROL OF SCHEDULES

13 What's done about controlling schedules?

These NPA divisions, in addition to processing CMP applications from, and allotting controlled materials to, manufacturers of "B" products, take what action they can to keep essential jobs, like All-American's, on schedule.

One way of keeping projects moving is by supervising "order boards" of builders of major equipment items—turbines and boilers, for example. E&TD's Turbine Section, for instance, keeps an eye on schedules filed by the builders.

They make sure that rated units get preference. They aim to see that units are delivered when needed—not later if it can be avoided, not earlier if it means delaying other essential units. In addition to shifting relative positions of units on order boards, they have the power (not yet used or needed) to divert units from one customer to another if urgent needs so dictate. Beyond this, E&TD's Coordination Section works with DEPA to see that equipment deliveries and construction progress keep in step.

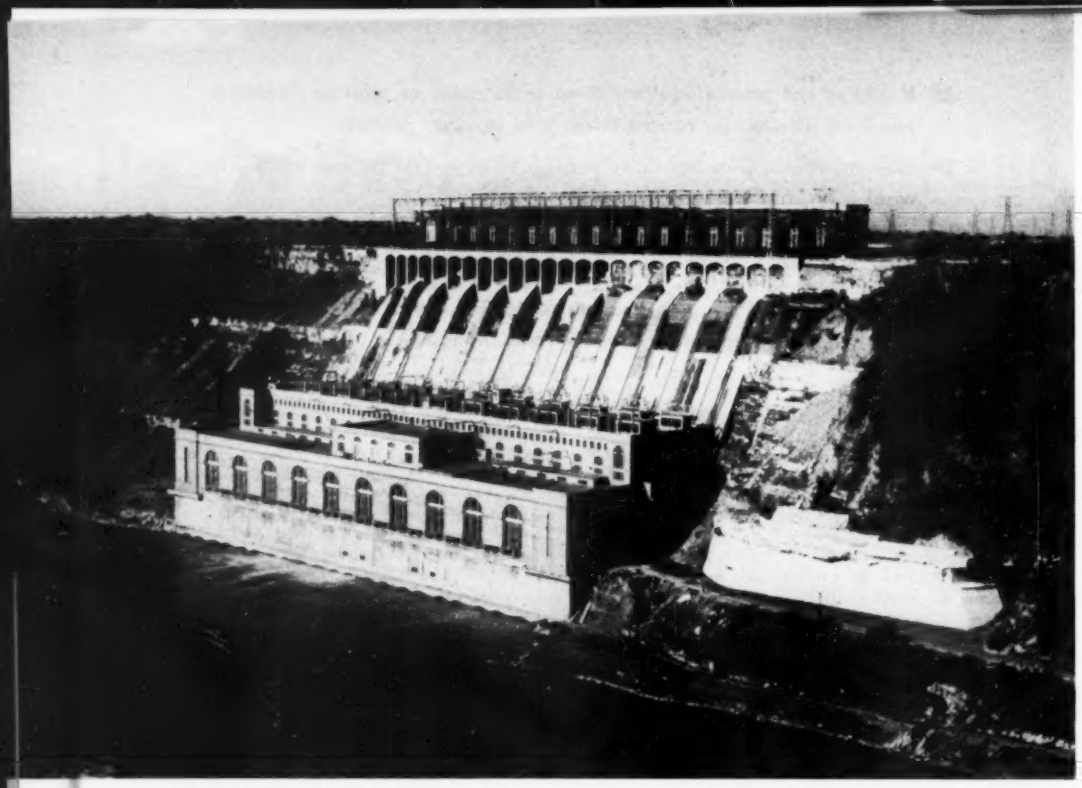
14 How about "A" products, other materials?

Besides placing orders for equipment, All-American Power Co files with DEPA for the quantities of controlled materials needed for direct use (reinforcing rod, etc) and for "A" products (structural steel, fabricated pipe, etc). As job schedule requires, these are allotted by the claimant agency, DEPA in this case.

If amount of controlled materials NPA and DEPA have available for allotment is enough to go around, and no hitches develop, All-American's project will be completed just about on time. If there aren't enough materials to go around, as is the case now, All-American's job may get pushed back.

15 What about industrial power jobs?

Industrial and institutional power plants have no single claimant agency like DEPA to turn to, so their procedure isn't as simple and clear-cut. But now that we've got a basic picture of CMP and how it operates in a typical case, we're ready to tackle (next month) the job of digging out practical answers for industrial and institutional plants.



QUEENSTON PLANT. Now Sir Adam Beck-Niagara No. 1, it has 525,000 hp installed in ten units. Plant uses maximum economic head, 315 ft, of total 327 ft between Lakes Erie and Ontario. Screen and gate house are on cliff above the plant

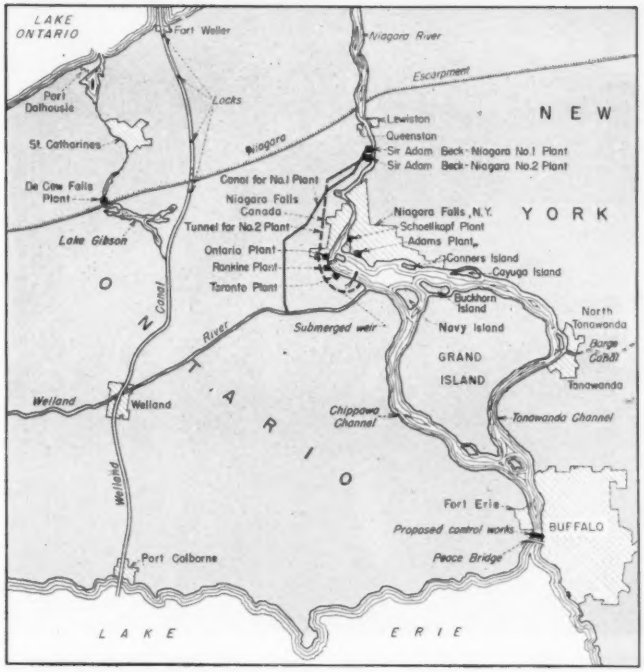
Canada Builds a 1,200,000-Hp

Hydro-Electric Power Commission of Ontario is developing new power project on Niagara River. For its length, it will have the world's largest power tunnel, for six 100,000-hp units under 300-ft head. Later, this project will be duplicated

► LAST YEAR Canada and the United States ratified a treaty that paved the way for both countries to divert more water from the Niagara River for power generation. To help meet its tremendous increase in load, The Hydro-Electric Power Commission of Ontario has well under way a 1,200,000-hp development to use its share of the water under the maximum economic head between Lakes Erie and Ontario. Contracts have been let to drive a 5-mile tunnel, 2.5 miles of canal are being excavated, and six 100,000-hp units are on order to go into operation in 1954 and '55.

Largest Power System. The Commission operates one of the largest power systems in the world and serves practically the entire Province of Ontario. During 1950 the Commission generated and purchased 15,880,000,000 kwhr. In December of that year, primary peak demand was 2,798,985 kw, an increase of some 947,000 kw in five years since 1945. The great bulk of this increase was in the Southern Ontario System, which includes Niagara Falls and the International Section of the St. Lawrence River. In December 1950, primary peak demand of the Southern Ontario System was 2,360,864 kw.

To meet the demand for more power throughout Ontario the Commission placed in service some 611,000 kw of hydro capacity and 63,000 kw of emergency fuel-electric units between September 1947 and December 1950. By the end of 1955, the present construction program will add 574,000 kw of steam-electric and 794,000 kw of hyro-electric capacity; 450,000 kw of the latter will be in the Niagara Falls area. At that time the Commission will be operating 66 hydroelectric plants with a dependable peak capacity of 2,657,000 kw together with two main steam plants and six emergency steam stations having dependable peak capacity of 598,000 kw, or a total of 3,255,000 kw. This year 216,500 kw of hydro and 320,000



NIAGARA POWER PLANTS. There are now in Canada and the U.S. seven plants with a total installed capacity of 1,312,000 kw that take water from the Niagara River

Plant at Niagara Falls

PRESENT WATER DIVERSION AND POWER GENERATION AT NIAGARA

From a report by the U. S. Federal Power Commission

Plant Name	Net head, ft	Installed capacity, hp	Installed capacity, kw	Maximum water use, cfs	Max kw per cfs	Av daily water allotted cfs
U. S.						
Schoellkopf	215	452,500	365,000	23,400	15.6	23,700
Adams	135	116,500	80,000	8,800	9.1	8,800
Total		569,000	445,000	32,200		32,500
CANADA						
Queenston	294	525,000	392,000	17,030	21.8	15,200
Ontario	180	200,000	138,000	11,100	12.4	10,700
Toronto	137	146,000	108,000	15,500	7.0	15,000
Rankine	135	112,500	80,000	10,600	7.6	10,600
De Cew	280	200,000	149,000	7,600	21.0	3,930
Total		1,183,500	867,000	61,830		55,430

kw of steam capacity will go into operation, which will about balance available power supply with system needs. Total capital cost for the 10-year program from 1945 to '54 is estimated to be about $925,000,000, of which $157,000,000 will be spent on the new Niagara development.

Canadian Plants. Before describing the new Niagara Falls development let us first study conditions as they are now at the Falls. On the Canadian side are three plants. The Toronto Power Plant (on map) rated 108,000 kw, operates under a 137-ft head. It takes water directly from the river above the Falls and discharges through a deep tunnel under the Horseshoe Falls. Rankine, with 80,000 kw installed and 135-ft head, also takes water directly from above the Falls and discharges through a deep tunnel. Ontario plant, takes its water from the river about half a mile above Toronto plant. This water flows through three conduits to the top of the river bank below the Falls. From here it goes to a 138,000-kw plant operating under a 180-ft head on the river's edge.

In addition to the plants at the Falls, two over-all developments are made in Canada. The Queenston project, now Sir Adam Beck-Niagara plant No. 1, completed in 1930, turns the flow of the Welland River for about 4 miles, then conducts the water through an 8.5-mile open canal to a fore-bay, screen and gate house on the cliff above the power-house, (p 78). This plant has an installed capacity of 392,000 kw in ten units. At maximum load the head is 294 ft. Normal gross head is 315 ft, only 12 ft less than the total fall from Lake Erie to Lake Ontario.

DeCew Falls, the other over-all development, takes water from the Welland Canal into Lake Gibson and over the Niagara Escarpment to operate a 150,000-kw plant under 280-ft head.

Rankine plant, owned and operated by the Canadian Niagara Power Co, is licensed in Canada to produce 75,000 kw. All the other plants are owned and operated by The Hydro-Electric Power Commission of Ontario.

Power-Plant Capacity. Power plants on the Niagara River and Welland Canal in Canada have a total capacity of 867,000 kw. Of the total water now being diverted, 87,930 cfs, 55,430 go through Canadian plants. This includes 5000 cfs diverted from the Hudson Bay watershed into Lake Superior.

The table summarizes the water diversion and power generation in Canada along the Niagara River. About one half of the power generated in the Rankine plant and nearly all from 4000-cfs emergency diversion goes to the U. S., where 445,000 kw are installed.

One of the reasons for more power generation in Canada is the higher head under which much of the water is used. This is shown in the table under the heading "Maximum kw per cfs." The Queenston plant has the highest efficiency with 21.8 kw per cfs, followed by DeCew 25-cycle plant with 21.0 kw per cfs. In the U. S. the Schoellkopf

MODEL OF NIAGARA FALLS. Built near Toronto by The Hydro-Electric Commission, this model is 95 ft long by 37 ft wide, shows to scale upper rapids and Falls. On it, engineering studies are made for the best location of new plant's intakes

plant has the highest unit generation efficiency with 15.6 kw per cfs. Plants on both sides of the river are about equally efficient. So the difference in power generation per cfs is due largely to the head under which the water is used at the plants.

Old Treaty. The Boundary Waters Treaty of 1909-10 authorized a permanent daily water diversion from the Niagara River above the Falls for power generation of 36,000 cfs in Canada and 20,000 cfs in the U. S. During the war temporary additional diversions were agreed to of 18,000 cfs in Canada and 12,500 cfs in the U. S. Of the increased Canadian use, 5000 cfs were compensated for by water from the Hudson Bay drainage area.

Further additional use for power purposes in Canada included 1430 cfs diverted before the 1909-10 treaty. As a result the authorized diversion for power generation before the present treaty was 55,430 cfs in Canada and 32,500 cfs in the U. S., a total of 87,930 cfs. The chief reason for the increased diversion in Canada is that capacity there is available to use the water in old plants, held in standby and emergency service.

New Treaty. The new treaty is rather flexible, written first to protect the scenic beauty of the Falls and Gorge, and also to permit maximum available water for power generation. During the tourist season (April 1 to October 31) from sunrise to sunset 100,000 cfs must flow over the Falls. All water in excess of this can be used for power purposes. At night (sunset to sunrise) flow in excess of 50,000 cfs can go to power generation.

During the nontourist season (Nov 1 to March 31) all flow in excess of 50,000 cfs, can be used for power except when it is necessary to flush ice out of the gorge below the Falls. Under the new treaty, half of the diversion will be available in Canada and half in the U. S. Canada is allowed an additional 5000 cfs of water that the Commission diverts from the Hudson Bay drainage area.

The treaty does not permit much more water to be diverted in day time during the tourist season than is now being used under the 1909-10 treaty and temporary agreements. So the scenic beauty of the Falls will be amply preserved. In fact, it will probably be improved, if this is possible, when proposed remedial works are completed to give a better water distribution. Erosion of Horseshoe Falls will also be reduced.

To use Canada's share of the increased diversion, much of which now goes to old plants at the Falls, The Hydro-Electric Power Commission of Ontario, as already mentioned, has started work on a second over-all development. This plant will be known as the Sir Adam Beck-Niagara No. 2 Generating Station.

Models of Niagara Falls. To divert water from the Niagara River involves many complicated hydraulic problems. To be sure the best solutions will be found, Hydro Commission has built a model of Niagara Falls at its Islington Service Station, near Toronto. U. S. Corps of Engineers has also built one in its hydraulic laboratory at Vicksburg, Miss. The former, shown above, includes the Falls and intakes of all power plants in Canada and the U. S. The Engineer Corps' model includes not only the Falls but also the Niagara River to Lake Erie, (p 19). The Hydro engineers and the U. S. Corps of Engineers are cooperating in this work, even to an equal division of expenses of building and operating the models, as far as they apply to remedial works.

Hydro's model, above, about 95 ft long by 37 ft wide, shows to scale the upper rapids, the river contours and the Ca-

NIAGARA FALLS. Flow in Niagara River is about 200,000 cfs, of which 100,000 cfs will flow over the Falls in the daylight hours during the tourist season

nadian and American Falls. Intakes for the Ontario, Toronto and Rankine plants are at *A*, *B* and *C*, respectively, with the Ontario plant at *D*, below the Horseshoe Falls. Intakes for the other plants on both sides of the river are duplicated in the model, but are outside the area shown in the photo. Discharge from the intakes is accurately measured with specially designed weirs.

Constructing the model required about 550 tons sand, 9000 board ft plywood, 25 cu yd concrete for the surface. Concrete channels around the structure and a sump hold 30,000 gal water used in the tests. Up to 1500 gpm can be pumped into the model.

The Commission's model was built to make detailed engineering studies for the correct design and location of the intakes for the Sir Adam Beck-Niagara Station No. 2. It will also be used to determine the necessary remedial works to preserve the scenic beauty of the Falls. The intakes for the ultimate development must take 40,000 cfs from the river, with a minimum head loss and disturbance to flow into the conduits. These intakes must also direct down the river the tremendous volumes of ice that come down from Lake Erie during winter and spring.

Power Tunnels. The new development when completed will have two pressure tunnels 50 ft in diameter on the rock-break line. With a 2.5-ft reinforced-concrete lining their inside diameter will be 45 ft, for a designed flow of 20,000 cfs each. One will carry water to operate six 100,000-hp units under a 300-ft head to be installed in the first section of Sir Adam Beck-Niagara No. 2 plant.

This tunnel will connect with the intake in the upper river by a 0.5-mile concrete-lined conduit. It will then slope down at a 30-deg angle to solid rock about 300 ft below water level at the intake and will run for about 5 miles, pass under the existing power canal and surface again, near the whirlpool. For its length it will be the largest power tunnel in the world. To drive it will require removal of nearly 2,000,000 cu yd of material. Construction of the new development will require excavating 7,000,000 cu yd of rock and other material and the placing of 900,000 cu yd of concrete and 25,000 tons of steel.

Tunnel-Intake Location. Intake for the tunnel will be between the submerged weir and the intake for No. 1 plant, as indicated on page 79. This location provides: (1) large quantities of water taken from the river with a comparatively simple structure (2) minimum interference by ice with water flow (3) shortest waterway on the Canadian side of the river for an over-all development using the maximum economic head.

One of the tunnels is now being driven and will connect to a 2-mile-long canal that will parallel the existing one. The new canal will have a capacity of 40,000 cfs, compared to 16,000 for the old one. The former has twice the capacity of one tunnel, but building the canal full size at this time will save considerable in construction costs when it is decided to build the second stage of the project.

The new and old canals will join near the forebays, which will be interconnected to serve both generating stations. From a new screen and gate house at the lower end of the forebay, six concrete-incased steel penstocks 450 ft long and 19 ft in diameter will go down the cliff to an equal number of 100,000-hp units in No. 2 plant about 400 ft upstream from No. 1.

The tunnel is one of the biggest parts of the project. Because of the magnitude of the work and to insure its completion on schedule, March 1, 1954, the tunnel has been divided into four contract sections. Contracts for two of the sections have been awarded to two Canadian companies — George Rayner and Atlas Construction, who operate together under the name Rayner-Atlas, Ltd. The other two sections are being built by B Perini & Associates, a U. S. organization. Four offset shafts, 210 to 330 ft deep, sunk to one side of the tunnel will serve both the present and second development and shorten the over-all construction time by about nine months. When construction is at its peak over 5000 men will be employed on the whole project.

Construction Started. A contract has been let to the Dominion Engineering Works, Ltd for six 105,000-hp turbines and their governors to the Woodward Governor Co. Three of the 75,000-kw generators are being built by the Canadian General Electric Co. Ltd, and three by the Canadian Westinghouse Co, Ltd.

Practically all construction work, except the tunnel, is being done by the Commission's construction organization, which had just completed the 480,000-hp Des Joachims and other projects on the Ottawa River when work was ready to start on the Niagara project. The Commission's engineering and research staffs are doing all the engineering and design work under the general supervision of R L Hearn, General Manager and Chief Engineer.

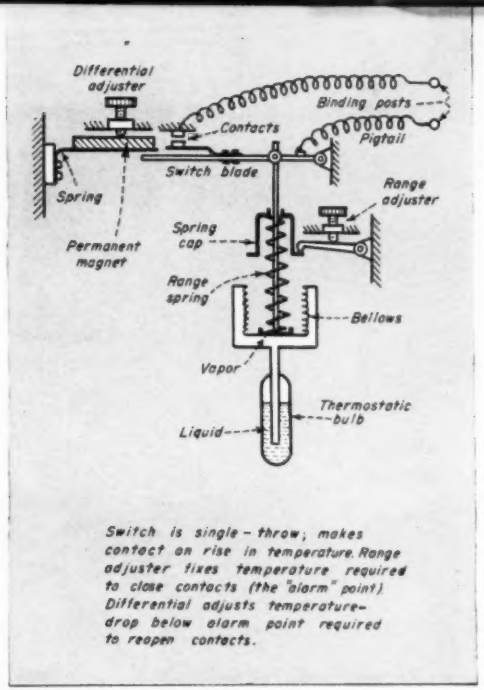
Diesel Instruments and Controls: 9

By EDGAR J KATES, *Consulting Engineer, New York, N. Y.*

Alarm Switches: How to Apply Them

Fast-acting and unsleeping safety devices not only insure better engine protection but also permit operators to supervise more units.

Here's a guide to the types available, and how they work—plus helpful pointers on using them to best advantage.



1 Simplified diagram of a single-throw temperature switch shows action of adjustments for range and differential

► SAFETY DEVICES for internal-combustion engines fall into two classes: (1) alarms to give warning of trouble (2) shutdown devices to stop engine before damage is done. Whether an alarm is sufficient, or engine should be stopped automatically, depends on nature of plant attendance and load. If an attendant is always nearby, an alarm is generally enough. He can act promptly, either to rectify the fault and keep the unit in service, or to stop the engine manually if he can't correct the condition before damage results. In other words, it's better, if possible, to let the operator decide if engine must be stopped.

For instance, if stopping the engine would sacrifice a vitally important load, it might be wise to take a chance on damaging the engine. On the other hand, if operator can't be relied on to act quickly and intelligently when an alarm is given and if the load is of such character that it can be dropped without serious loss, automatic shutdown insures against engine damage.

Alarm systems are usually electrical because warning can be given best by sirens, bells or lights and because electric annunciators are convenient to spot the faulty condition. Shutdown systems may be operated electrically or by direct mechanical action.

Safety devices should receive regular inspection, testing and maintenance to insure reliable action. A fault indicator may be called on to function only a few times during an engine's entire life but when needed it *must* work.

Operating conditions which can be protected by safety devices are:

Cooling-Water Flow. Usual indication of trouble is excessively high engine outlet temperature. An additional indication, often used in large plants, is abnormally low pressure of water at engine inlet. A pressure device operates sooner than a temperature device if water circulation slows down or ceases, because pressure falls immediately. Temperature indication isn't given until after water has heated to the alarm setting.

Lubricating-Oil Flow. If lubricating-pump delivery falls off, oil pressure drops to danger point more quickly at far end of system where pressure is naturally lower. Likewise, if an oil pipe springs a leak, pressure falls more quickly beyond the leak.

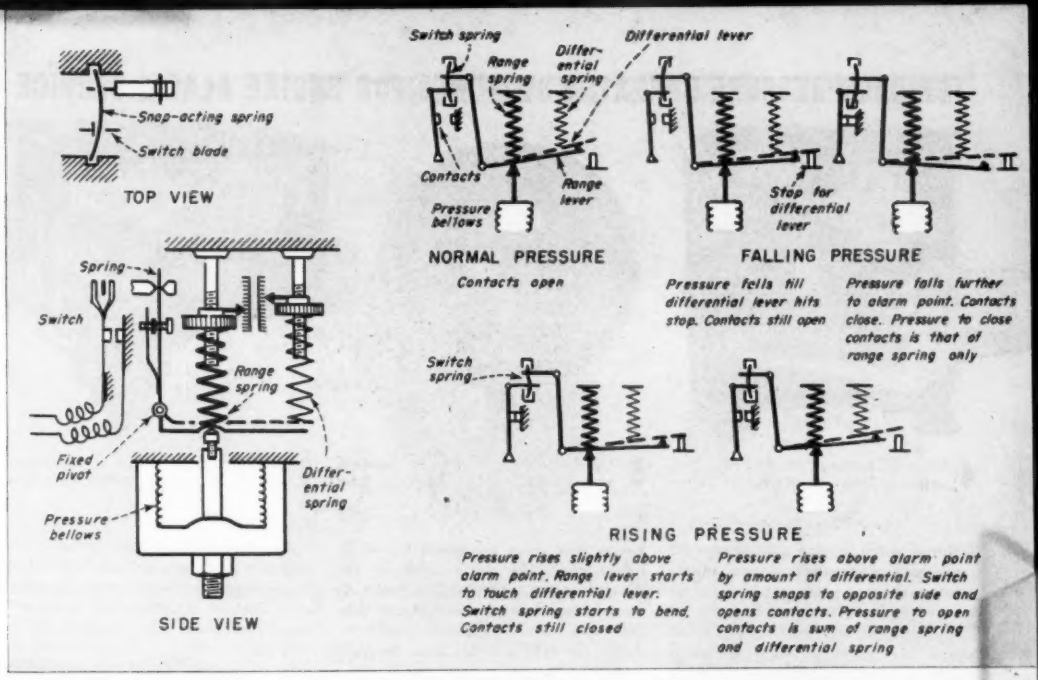
The far end of the system is thus the place to put an alarm device operated by oil pressure. It should be set to operate at a point slightly below minimum normal pressure but still above the danger point. In addition, devices responsive to high oil temperature are sometimes used, particularly on large engines having pistons cooled by circulating oil. If oil circuits are suitably subdivided and fitted with individual temperature devices, an overheated piston or bearing quickly makes itself known.

Engine Speed. An overspeed stop prevents a runaway if regular governor fails or if load is suddenly lost on an engine not equipped with a governor. Overspeed protection is always arranged to stop engine at once, rather than give an alarm, because of rapid acceleration and possible severe damage. Overspeed controls are usually actuated by centrifugal force.

Day-Tank Level. When day tanks are filled by motor-driven pumps under automatic control, high-level and low-level alarms may be used to signal any trouble in the fuel-transfer system.

Starting-Air Pressure. Starting air-tanks should always be kept at full pressure. In plants where the precaution is justified, each tank is fitted with a pressure switch to sound an alarm if pressure drops too low. Means are generally provided for disconnecting the alarm during the starting period, when pressure naturally falls.

Bearing Temperature. Fitting thermostatic elements into the main bearings is a simple matter in most engines. Such elements can be used either to sound an alarm or stop the engine if a main bearing becomes hot. They do not di-


Snap-acting spring
Switch blade
TOP VIEW
Spring
Switch
Range spring
Fixed pivot
Differential spring
Pressure bellows
SIDE VIEW
Switch spring
Range spring
Differential spring
Differential lever
Contacts
Range lever
Pressure bellows
NORMAL PRESSURE
Contacts open
Stop for differential lever
FALLING PRESSURE
Pressure falls till differential lever hits stop. Contacts still open
Pressure falls further to alarm point. Contacts close. Pressure to close contacts is that of range spring only
Switch spring
RISING PRESSURE
Pressure rises slightly above alarm point. Range lever starts to touch differential lever. Switch spring starts to bend. Contacts still closed
Pressure rises above alarm point by amount of differential. Switch spring snaps to opposite side and opens contacts. Pressure to open contacts is sum of range spring and differential spring

2 Switch shown diagrammatically above uses bowed spring for snap action, needs little movement

3 Significant steps in operation of switch in Fig. 2, with contacts closing on falling pressure. Note range and differential action

rectly protect crankpin bearings, however, and these are more apt to heat.

Exhaust Temperatures. Although exhaust pyrometers are generally used to give visual indications, they are occasionally fitted with electric contacts or electronic switches to sound an alarm (POWER, Sept 1950, p 100). Such alarms have been used, for example, in the huge engine installations for aluminum-reduction plants (POWER, July 1950, pp 76-81). They have also been applied to control the loading of individual small engines mechanically connected to a common load.

Requirements. Many devices for safeguarding engine operation have been specially designed for the purpose. Some, however, particularly electric temperature and pressure switches, were originally developed for other applications. In selecting such devices, take care that they are suitable for engine service, which involves operating conditions frequently quite unlike the original applications. In particular, alarm and shutdown devices should meet the following requirements:

1. They must be dependable and rugged enough to give years of unfailing service under severe conditions.

2. Materials used should not be affected by corrosive agents or contaminants met in engine service—water containing oxygen or minerals, acid products formed in lube oils, exhaust gas carrying sulfur compounds.

3. Equipment to be mounted on engine itself must be designed to resist vibration without failure or impairment of accuracy.

Electrical alarm systems require: (1) fault switches to measure conditions and close or open contacts when any condition becomes abnormal (2) warning devices to give an alarm (3) fault-locating devices to point out which condition is at fault, and (4) energizing devices to put system in operation whenever engine is running.

Fault switches should always be supplemented by indicating devices that show temperature, pressure or other condition at the fault switch. This permits checking the setting and operation of the fault switch. These indicating devices are usually the ones used for normal operating control. Proper location of fault switches calls for even greater care than location of indicating devices. For example, a thermometer in cooling-water discharge pipe from engine shows engine outlet temperature correctly even if placed several feet from the engine itself. But this location is wrong for the fault switch because, if water stops flowing and engine jackets start to overheat, rise in temperature will take too long to reach switch. So put switch in jacket itself.

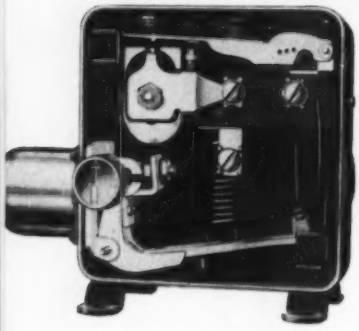
Switch Requirements. Principal needs of fault switches are accuracy, sturdiness and ability to resist corrosion and vibration. Contacts should have quick make-and-break to avoid excessive arcing. Single- and double-throw switches are used. Open-circuit systems generally have single-throw switches, arranged to close on rising temperature (water or bearings) or to close on falling pressure (lube oil or water).

In some designs, switch is factory calibrated and sealed at a fixed setting. In others, setting may be more or less easily adjusted in the field. In the latter case, select instruments designed to prevent unauthorized changes in control points. If adjustment is by knobs, they should be covered or inside the case; if by external screws, they should be inconspicuous.

Most fault switches use simple, flat, silver-to-silver contacts, often with a permanent magnet to pull contacts firmly together with a snap action when armature moves to closing position. Permanent magnet also causes snap action when contacts open, because it holds contacts together until pull is strong enough to overcome magnetic force. Such switches are often made with two adjustments, one for "range" and one for "differential."

Range, Differential. Fig. 1 shows diagrammatically the action of a tem-

TYPICAL PRESSURE-OPERATED SWITCHES FOR ENGINE ALARM SERVICE



4 Pressure bellows (in housing, *left*) actuates this double-throw switch

5 Tilting mercury switch is operated by pressure-sensitive bourdon tube

6 Heavy cover clamped over rubber gasket makes pressure switch watertight

perature switch having adjustments for range and differential. Range adjustment establishes point at which circuit is *closed* by rising temperature. It works by adjusting the spring force that resists the vapor pressure produced inside the actuating bellows by a volatile liquid in a thermostatic bulb.

Differential adjustment controls amount of temperature drop needed to reopen the circuit. It works by adjusting position of permanent magnet. The nearer the magnet is placed to the blade carrying the contact, the stronger will be the force holding the contacts together and the greater will be the differential. Thus increasing differential increases snap action.

Snap Action. Another form of switch with snap action uses a bowed spring which snaps from one extreme position to the other. Fig. 2 shows this construction diagrammatically, as found in a compact type of switch designed in such a way as to require little movement to operate it. Device shown has both range and differential adjustments and is designed to close contacts on falling pressure. Fig. 3 shows significant steps in its operation. Note that point to which pressure must fall to close contacts is controlled by range spring only. Point to which pressure must rise to reopen contacts is sum of pressures produced by both range and differential springs.

Nonadjustable differentials are often preferred for alarm switches because the *alarm point* can be established by range adjustment only. For example, a low-pressure alarm in an open-circuit system employing single-throw switches operates when contacts close. Contact opening point is at higher pressure, as determined by the differential. Hence adjusting the range fixes the alarm point at a certain low pressure. The alarm having been given, the pressure must be raised *above* the alarm point by the amount of the differential in order to reopen the alarm contacts. Ordinarily there is no need to adjust this differential in the field if it has been properly set at the factory.

Similarly, alarm point of a temperature switch in an open-circuit system can be set directly by adjusting the range. High water temperature causes contacts to close and give the alarm. After water temperature has fallen by amount of differential, contacts open and alarm ceases. Here again, there is no need to adjust differential in the field.

In closed-circuit alarm systems, double-throw switches are often used. When condition is normal, switch is in "pilot" position and lights a lamp. When trouble occurs, the switch snaps to "alarm" position. The pressure or temperature at which this occurs can be set by range adjustment only.

Double-throw switches are generally similar to their single-throw cousins except that an extra pair of contacts is provided on other side of switch blade. In many designs, however, extra contacts hold with less pressure and hence can carry less current—sometimes as little as one-tenth. Take care, therefore, on heavily loaded alarm circuits not to overload extra contacts.

Amount of Differential. Although flat-contact type of switch requires differential action to give quick make-and-break, firm contact and positive positioning, amount of differential shouldn't be excessive. For example, con-ider an engine with normal water outlet temperature of 160 F. Alarm signal is desired if temperature rises to 170 F. If differential were 15 F, temperature off the engine would have to fall to 155 F, or *less than the normal temperature*, before the switch moved out of alarm position.

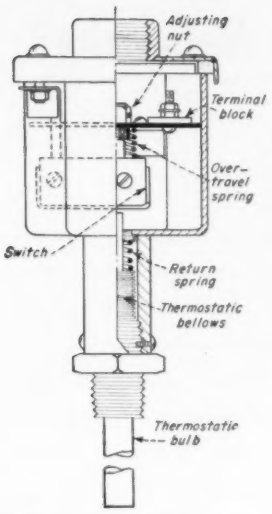
An interesting fact about differentials is that in a temperature switch actuated by pressure of a volatile liquid (as many are), amount of differential is not the same throughout the range, even if differential setting is fixed. Amount of differential runs *less* when alarm point is at *high* end of range than when at *low* end. For instance, a switch, having a range of 100 to 225 F and a nonadjustable differential, might have an actual differential of 14 F with alarm point at 100 F, and only 6 F with alarm point at 225 F. This results from the fact that vapor pressure of the volatile liquid changes faster at high temperature than at low.

Switch Calibration. Adjustable pressure and temperature switches made for general application often have calibration scales on range and differential adjusters. When such switches are used in engine alarm systems, scale readings may be misleading. Consider a switch intended to close on rise of pressure, as used in refrigeration systems. Suppose the range-adjuster scale shows 9 psi and the differential 5 psi. When used as intended, switch closes as pressure rises to 9 psi and reopens when pressure falls to 4 psi (9—5).

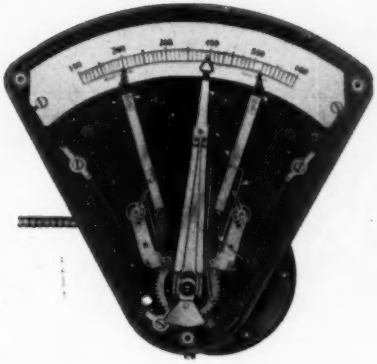
Since the switch *closes on rise of pressure* it may also be used to *open on fall of pressure*, as might be wanted in a closed-circuit alarm protecting an engine-lubricating system. In this case switch would normally be closed. It would not open and give the alarm until oil pressure fell to 4 psi instead of 9 psi shown on range-adjuster scale. For the above reason, and others, it's best, for engine use, to disregard calibration scales. Instead, subject the fault switch itself to the desired alarm pressure or temperature and then adjust it to operate there.

Mercury Switches. Fault switches are

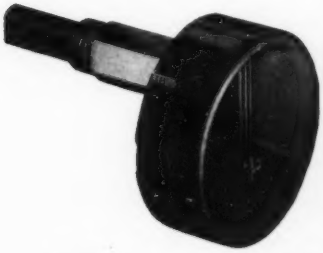
SOME TEMPERATURE-ACTUATED SWITCHES

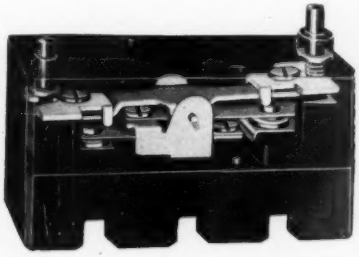


7 Temperature switch uses vapor pressure of a volatile liquid

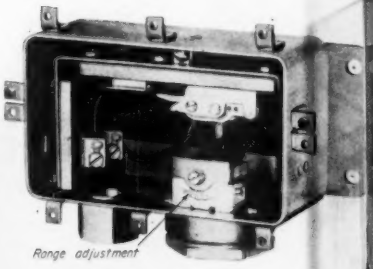


8 Contact mechanism on dial thermometer may be used to warn of high temperature





9 Compact temperature switch, *left*, particularly suited for use on bearings has spiral-wound bimetal helix inside brass well. Switch mechanism, *right*



10 Shockproof, watertight temperature switch with metallic bellows using a volatile liquid. Lower view shows the details of its internal construction

usually of the simple contact type, with snap action. Although these are compact, reliable and inexpensive, switches of the tilting mercury type are sometimes preferred. Being hermetically sealed, contacts are unaffected by dirt or corrosion and they produce no open spark. Snap action comes from a pivoted compression spring. Mercury switches of double-throw type carry full rating on either throw.

Pressure switches may be actuated by a metallic bellows, a diaphragm or a bourdon tube. Fig. 4 shows a bellows-actuated, double-throw pressure switch with silver contacts and snap action produced by a permanent magnet. Specially designed for alarm and shutdown service, it is factory set. An additional feature is a manual control knob, which must be turned to ON position until engine starts and oil pressure comes up to normal.

In Fig. 5 the pressure switch has a bourdon tube actuating a tilting mercury switch. Fig. 6 shows a pressure switch (cover removed) designed to resist drips or direct spray. The watertight seal consists of a rubber gasket clamped to the face of the case by a heavy cover plate. A bellows operates the switch; a permanent magnet gives snap action of contacts.

Temperature switches are commonly actuated by a bellows or bourdon tube similar to those in pressure switches. Volatile liquid in a thermostatic bulb produces the pressure. Another type uses the bimetallic principle: such switches are available hermetically sealed in glass tubes containing an inert arc-quenching gas.

Alarm contacts are sometimes applied to dial thermometers, but current capacity is limited. A special kind of temperature switch is an indicating exhaust pyrometer fitted with an electronic switch, previously mentioned. This operates satisfactorily with the minute force available.

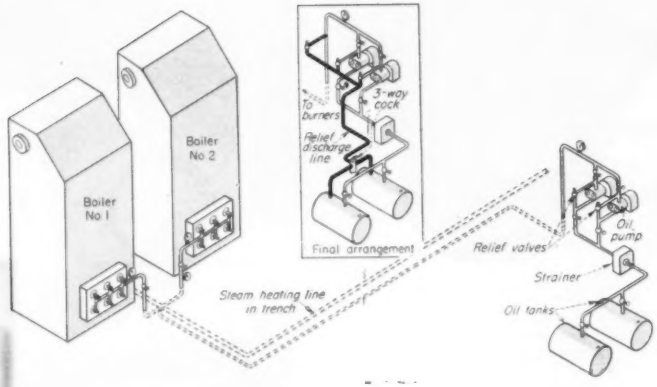
The temperature switch of Fig. 7 is factory set. Vapor pressure of volatile liquid acts on bellows which operates the switches. The compact temperature switch of Fig. 9 is particularly suited for use on bearings. Inside the brass well is a spiral-wound bimetal helix. Switch mechanism is also shown.

Dial Thermometer. Fig. 8 shows a dial thermometer with contact mechanism. Illustration shows two adjustable contact arms, *A* and *J*, on either side of indicating pointer *B*. In engine work, however, only one contact arm is used, since only a high-temperature alarm is needed (or a low-pressure alarm if used with a pressure gage). Indicating pointer carries an insulated silver contact button *K* connected to terminal by hairspring *M* at pivot.

The adjustable arm provides the

(*Continued on page* 204)

Rx Could You Cure This Headache?



▶Don Swift, Ebasco Services Inc, again reports on working bugs out of new power-station equipment . . .

▶A few mils excess clearance, small design changes in layout, poor selection of sizes are only minor variations, but they can cause endless trouble till corrected . . .

Case No. 5—THE ERRING FUEL OIL SYSTEM

▶ THIS IS HOW we solved a series of troubles in a fuel-oil system supplying lighting-off torches for boilers of a new large central station. Equipment included two 4000-gal underground tanks for light fuel oil, and two 1000-gph remotely controlled motor-driven gear pumps. System was laid out as shown in sketch. Pumps stood in a pit in one corner of the water-treatment building, adjacent to the oil tanks. These units are regulated from the power-plant control room, some 300 ft away. For over half the distance the oil line runs in the same trench with a steam heating main.

In starting the system we discovered that several design changes caused the pump suctions to be above the oil level in the tanks. To avoid damaging the close clearances, the pumps had to be primed and lubricated by pouring oil into test plugs on the discharge side. Having done this and checked strainer cap, pipe joints, valve packings and the like for leaks, the pumps were able to pull oil. With oil-header valves closed in the plant each pump was run separately and its pressure relief valve adjusted to open at 260 psig, less than the pump maximum pressure.

Trouble. We had two sizes of oil-burner tips, the smaller used 20 gph at 250 psig and the larger 600 gph. Six small tips could only raise boiler pressure to 300 psig during boil-out, even though the oil pumps were recirculating excess oil. We used one large tip intermittently to raise steam to full pressure, for setting safety valves and blowing out main steam piping.

Even with both pumps running, oil header pressure would drop to 60 psig with one large tip in service. This caused poor atomization and combustion. With only the small tips, the east pump, having slightly shorter connections, took the load and the west pump recirculated its oil back to its suction and gradually got warmer and warmer. As it did, oil viscosity dropped and leakage through pump clearances increased till pressure dropped so low the relief valve closed. This further reduced heat-radiating surface. Several times we found the west pump smoking hot. When oil demand ceased, both pumps would heat up rapidly if not shut down promptly.

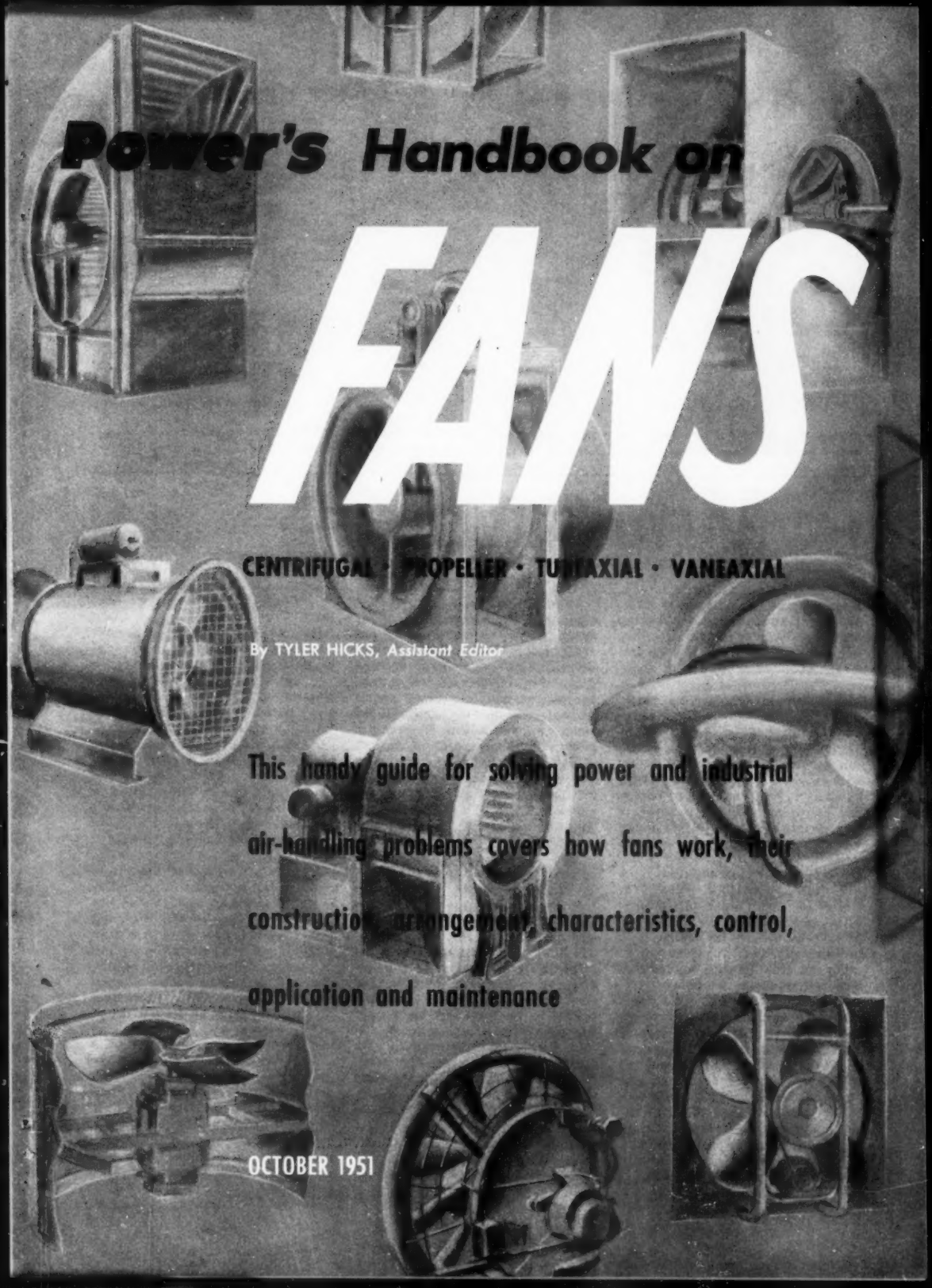
We decided it was time to find out what was going on. Installing test connections on each pump, we discovered the west pump pressure was 20 to 30 psig lower than the east pump at dead shutoff. We set relief valves at slightly lower pressure, even though warm oil or wear might reduce discharge pressure. Pump suction lift was only about 2 to 4 in. Hg.

To assure proper pump cooling, we moved relief discharge lines from pump suction, see sketch, back to oil tanks. The two relief lines were joined into one and run to a 3-way cock. Return flow cannot be shut off but can be routed to the tank supplying the oil at a given time.

More Trouble. The heating season caused the oil system to kick up again. A few minutes after burner valves were shut and pumps stopped, the pressure in the oil header would rise rapidly to 600 psig and more. Several pressure gages were ruined before we found the cause. Because burner valve and pump check valves were holding tightly, expansion of the cold oil in the line as it heated up from proximity to the steam heating line, caused the large, rapid pressure rise. Draining off a small amount of oil dropped the pressure until the next firing cycle. We installed a relief valve, set for 300 psig, on the pump discharge header carrying fuel oil back to the tanks, via the pump-relief discharge line and 3-way cock.

The pumps continued to give trouble with low capacity and pressure and by need for priming. To speed up air removal from system before burners were turned on a bypass line from discharge header to relief-valve discharge line was installed. We waged a campaign to eliminate air leaks from the system. We removed pump-discharge check-valve internals and ran the pumps to build up pressure in the header. Closing the

(Continued on page 214)



Power's Handbook on FANS

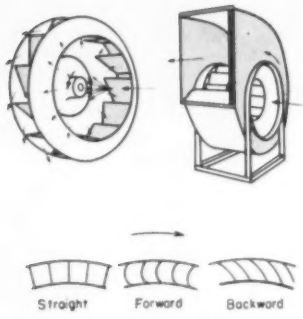
CENTRIFUGAL · PROPELLER · TUBEAXIAL · VANEAXIAL

By TYLER HICKS, *Assistant Editor*

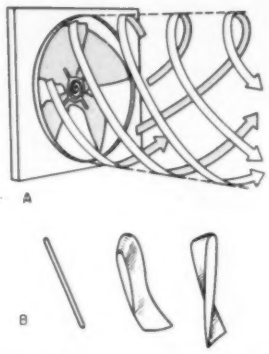
This handy guide for solving power and industrial air-handling problems covers how fans work, their construction, arrangement, characteristics, control, application and maintenance

OCTOBER 1951

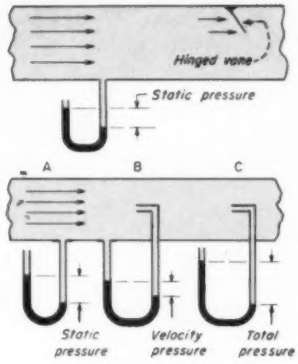
AIR FLOW . . . Fans add energy to air or gas



CENTRIFUGAL FANS whirl air between the blades, have one of several blade shapes



PROPELLER FAN, *A,* can move large volumes; *B,* typical disk and airfoil shapes



FAN PRESSURES can be measured with manometers connected to or inserted in duct

HOW FANS WORK

Moving air or gas from one point to another is an important engineering problem. Common machine for this purpose is the fan. Moving air means overcoming friction or resistance to flow. This resistance is always present whether air moves through a duct, diffuser, fuel bed or cooling tower. Since overcoming resistance is *work,* we can look on a fan as a machine that supplies air with *energy* needed to move it. What happens is that mechanical energy fed to a fan's spinning shaft is transferred to the air or gas being handled to raise its pressure and velocity enough to overcome resistance present and cause flow.

AIR FLOW, PRESSURE, VELOCITY. Before tackling details of fan operation, let's study how air flows Since pressures we're dealing with are normally small, easiest way to study air flow is with water-filled manometers, as shown above.

Depending on how we insert manometer in duct, we can read, not one but three different pressures: static, velocity and total pressure.

Static pressure is that exerted on the walls of the duct, just like steam pressure on the interior of a boiler drum. We read this by connecting our manometer tube at right angles to the duct. Static pressure is what overcomes the resistance of ducts, fuel beds, filters, etc.

Velocity pressure is over and above static pressure. It's caused by the impact of the flowing gas and is felt only by surfaces the gas actually flows against. Imagine a duct under pressure but with a damper on one end, closed so no air flows. In this duct we hang a hinged vane, as shown above. Since static pressure will be the same on both sides, the vane hangs vertically. But when we open the damper so air flows, vane tips back from impact of air moving against its face. This added pressure is velocity pressure.

By connecting a manometer parallel to air flow as at *C,* above, we find pressure reading is greater than the static pressure. What we are measuring is *total pressure,* the sum of static and velocity pressure.

VELOCITY TO PRESSURE. Now a fan is primarily a machine for accelerating or speeding up air flow. Yet very often the static pressure needed to overcome friction is more important than a high velocity. So in many cases it's necessary to convert some of the velocity energy to pressure energy. This means slowing down the velocity gradually to increase the static pressure (with a resulting decrease in the velocity pressure). This is usually done either in the fan or its discharge duct by a diverging section or diffuser. Guide vanes are also used.

FAN TYPES. There are in general two types of fans: (1) *centrifugal* or *radial flow,* and (2) *axial flow.*

Centrifugal fans, above left, consist of a wheel mounted on a shaft with the whole assembly rotating in a scroll-shaped housing.

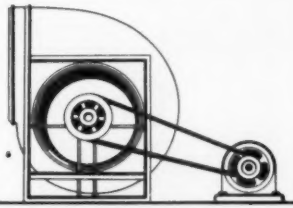
Axial-flow fans have two or more blades mounted on a shaft. Basic type is the *propeller* fan whose blades spin free or are mounted in a plain ring. *Tubeaxial* fans have a surrounding cylinder. *Vaneaxial* fans have guide vanes as well.

MAKING AIR MOVE. With centrifugal fans, air enters at the center or "eye" of the wheel, then makes a right-angle turn and passes between the blades of the revolving wheel. What the fan does is whirl a "chunk" of air between each pair of blades. This centrifugal action, similar to whirling a bucket of water on the end of a string, does three things: (1) "throws" the air out at a high velocity, (2) increases the air's static pressure and (3) sucks in more air at the wheel center. As the air leaves the blade tips, part of its velocity is converted to additional static pressure by the divergence of the scroll-shaped housing from the circular wheel. An outlet diffuser gives even more velocity-to-pressure conversion.

FAN TYPES . . . There's a right fan for every job

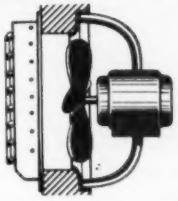
CENTRIFUGAL

Designed to move air or gas over wide volume range. Usual static pressures go up to 25 in. water, special fans to 90 in. Wheel has straight, forward-curve, backward-curve, radial-tip or other type blades. Housing is sheet or cast metal with or without protective coat of rubber, lead, enamel, etc. Belt or direct drive



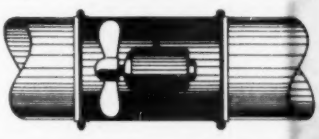
PROPELLER

These are designed to move air from one enclosed space to another or from outdoors to indoors or vice versa in a wide range of volumes at low pressure (0 to 1 in. water, static). Automatic shutter on discharge is not part of fan. It protects fan from wind, rain, snow, cold during shutdown. Belt or direct drive



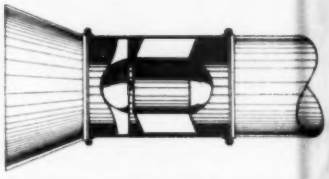
TUBEAXIAL

Axial-flow wheel in cylinder moves wide range of air or gas volumes at medium pressures (¼ to 2½ in. water, static). Belt or direct drive. Fan may be mounted in air or gas duct. Blades may be disk or airfoil type



VANEAXIAL

This fan has a set of air guide vanes mounted in cylinder before or behind airfoil-type wheel. It moves air over wide range of volumes and pressures. Usual pressure range is ½ to 6 in.; special designs can go up to 60 in. or higher. Wheel often made of sheet metal but cast metal is also used. Belt or direct drive



Axial-flow fans don't use centrifugal force to increase pressure. They depend on the screw action of disk-like blades or airfoils to speed air in a straight-through flow. Air is sucked in by leading edge of spinning blade to discharge with a helical motion from trailing edge. Guide vanes in vaneaxial fanes straighten helical pattern so air has little or no spin. Disk blades are often flat and set at an angle with shaft. Airfoils have special shapes (like a stubby propeller), give high efficiency.

BLOWERS, COMPRESSORS. No definite line exists between fans and their high-pressure counterparts — blowers and compressors. In general units for high-pressure work are compressors; those for low-pressure use are fans. Blowers usually run in the middle pressures.

SOME DEFINITIONS USED IN FAN WORK*

STANDARD AIR DENSITY is 0.075 lb per cu ft at sea level (29.92 in. barometric pressure), dry air, and 70 F

STANDARD FLUE-GAS DENSITY is 0.078 lb per cu ft at sea level (29.92 in. barometric pressure) and 70 F

VOLUME handled by a fan is the number of cubic feet of air per minute (cfm) expressed at fan outlet conditions

TOTAL PRESSURE of a fan is the rise of pressure from fan inlet to fan outlet

VELOCITY PRESSURE of a fan is the pressure corresponding to the average velocity determined from the volume of air flow at fan outlet area

STATIC PRESSURE of a fan is total pressure minus the fan velocity pressure

POWER OUTPUT of a fan is expressed in horsepower and is based on fan volume and fan total pressure

POWER INPUT is measured horsepower delivered to fan shaft

MECHANICAL EFFICIENCY of a fan is ratio of power output to power input

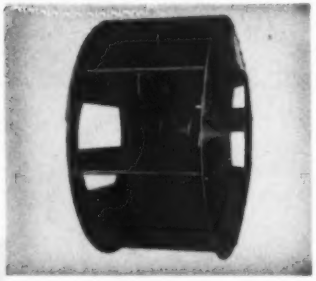
STATIC EFFICIENCY of a fan is the mechanical efficiency multiplied by the ratio of static pressure to the total pressure

FAN OUTLET AREA is the inside area of the fan outlet (flange)

FAN INLET AREA is the inside area of the inlet collar

*From the National Association of Fan Manufacturers, Inc, (NAFM).

CENTRIFUGAL FANS

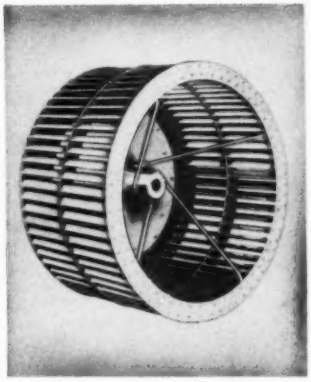


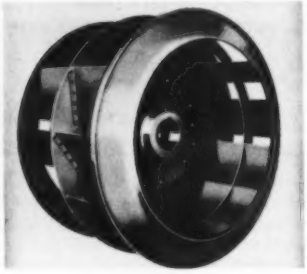
← STRAIGHT-BLADE WHEEL

Spider built up from hub carries about 4 to 12 steel-plate blades. Or a central plate may support the blades. Blade liners on this unit permit it to handle abrasive gas

FORWARD-CURVE WHEEL →

Backplate or central steel disk holds one end of blades; shroud ring with/without tie rods, other. Or else central arms as on straight-blade wheel. 24 to 66 blades



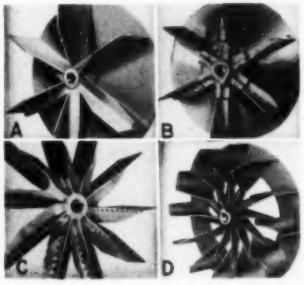


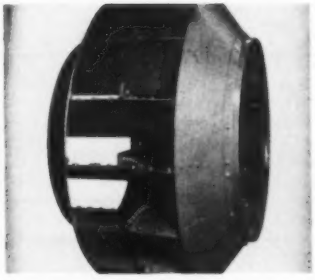
← BACKWARD-CURVE WHEEL

High-speed units, sturdily built. Central or backplate. Shroud ring with or without tie rods supports about 16 blades

CONVEYING WHEELS →

Welded wheel *A* and built-up wheel *B* handle wool, other stringy materials. *C* vents pulverized-fuel systems; *D* handles most any material



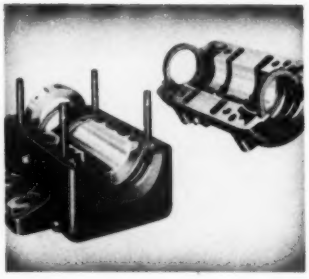


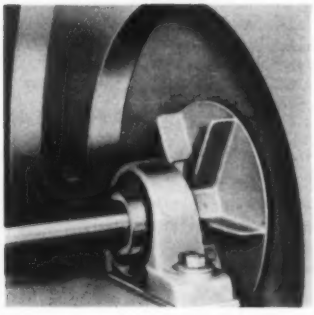
← RADIAL-TIP WHEEL

For solid-fuel, i-d use. Wheel has removable ribbed-liner blade faces. Center supports cut away for smooth flow. Double inlet cuts abrasion

PILLOW-BLOCK BEARING →

For draft fans all parts of bearing are split: oil rings, thrust collars and seals. Water cooling often used. Fans for other jobs may have ball or roller bearings



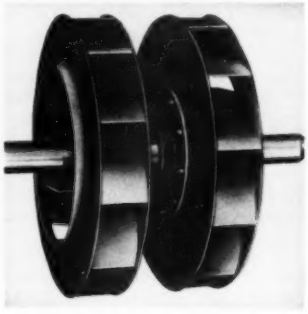


← "HEAT FLINGER"

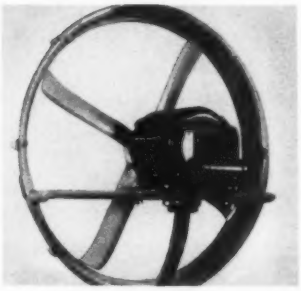
Protects bearing from heat traveling along shaft. It's a small fan firmly attached to shaft; dissipates heat from air or gas in fan

DOUBLE WHEEL →

Double-inlet fan with two wheels for f-d service. Wheels are welded, heavy-duty. Backward-curve blades. Unit has good efficiency



PROPELLER FANS

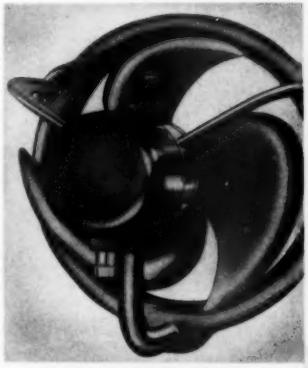


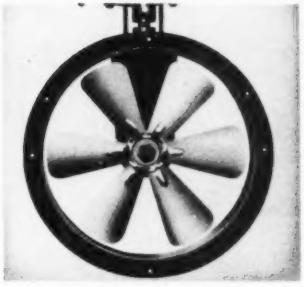
←FOUR-BLADED

Direct-connected totally enclosed ball-bearing motor drives fan in vertical, horizontal position. Orifice mounting ring smoothes flow

HIGH-SPEED UNITS→

Where moderate noise is allowed, small-size fans driven by high-speed motors move large air quantities. Self cooled





←BELT-DRIVEN

For fume exhaust service. Pulley, belt, enclosed in vapor-proof housing. Sheet-brass blades, cast-brass hub, enclosed motor

MAN COOLER→

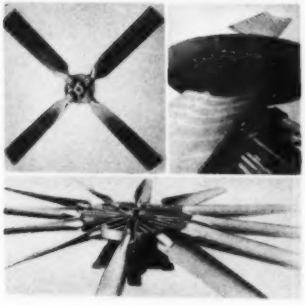
Portable fan cools men, products, has many other industrial uses. Steel cylinder and mesh protect blades, make fan safe

←TWO-BLADED

Belt-driven two-bladed propeller fan discharges air vertically up. Motor may be mounted above or below fan, as needed

TRANSFORMER-COOLING→

To prevent high internal temperatures and increase capacity, fans scour transformer surface with cool air. Weatherproof, adjustable



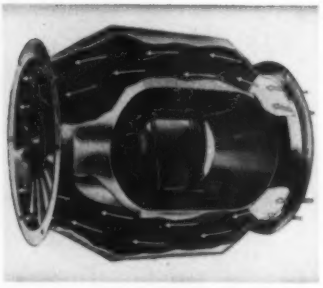
←COOLING-TOWER FANS

For towers and other services, fans with large diameter may be used. These have adjustable pitch, are lightweight, corrosion-resistant

ADJUSTABLE BLADE→

This adjustable-pitch blade, one of many designs used, permits selection of most economical setting for the air-moving job being performed

TUBE- AND VANEAXIAL FANS

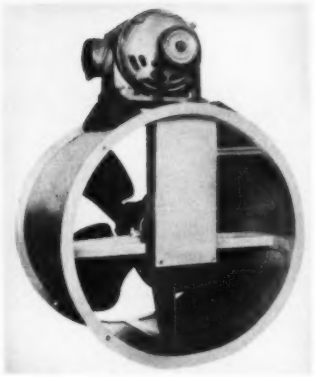


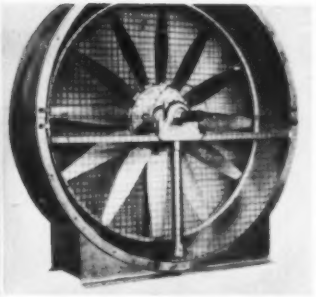
← DIRECT-CONNECTED

Hot, corrosive, flammable or explosive gas is exhausted by this fan with split housing. Motor in separate chamber open to atmosphere

BELT-DRIVEN →

Where hot or corrosive air or gas is handled, motor may be outside duct with fan driven by belt. Fan cylinder connects directly to duct



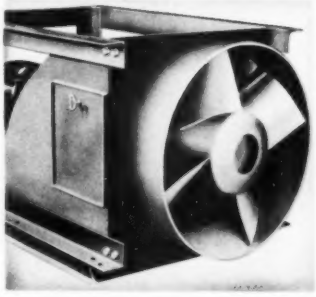


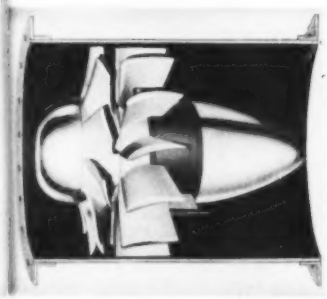
← FOR MINE VENTILATION

Where pressures up to 2 in. water are needed, this unit serves as an auxiliary, or for ventilating remote sections of all type mines

ELBOW-TYPE DUCT FAN →

Supplies or exhausts air. Motor is out of air stream. Unit has self-unloading feature: as resistance increases, motor load falls



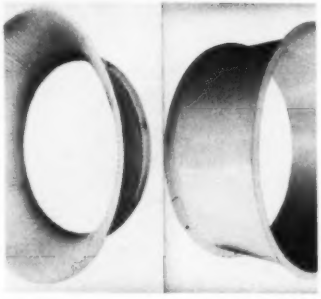


← AIR SUPPLY, EXHAUST

This vaneaxial fan handles moderate-temperature non-corrosive air. Vanes give discharged air straight-line axial flow at higher pressure than with propeller fan

BELL INLET; DIFFUSER →

To reduce inlet losses, a bell, left, is used with some fans. Diffusers, right, convert discharge velocity to pressure, can save hp

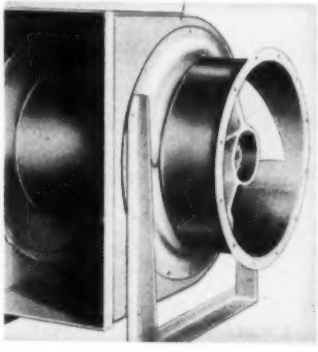


← VENTILATION SERVICE

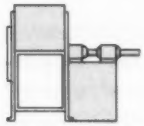
Direct-driven vaneaxial fan. Permanently sealed motor bearings; formed lightweight frame. Can be finished for corrosive work

ELBOW AXIAL FLOW →

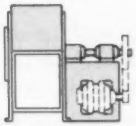
Provides 90-deg change in direction of air flow; has bearings in cone out of air stream. For paint spray booths, heat-treating ovens, fume exhaust and similar jobs



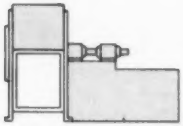
ARRANGEMENTS



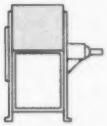
No. 1 SW SI: Overhung wheel, 2 bearings, belt/direct drive



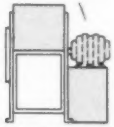
No. 9 SW SI: Prime mover on side of base. For belt drive



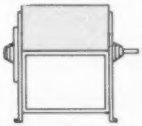
No. 8 SW SI: Arr No. 1 with base for driver. Belt or direct



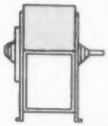
No. 2 SW SI: Belt or direct, bearing bracketed to housing



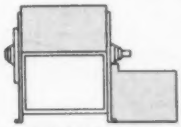
No. 4 SW SI: Direct, no fan bearings, the wheel overhangs



No. 3 DW DI: Belt or direct. Housing supports the bearings



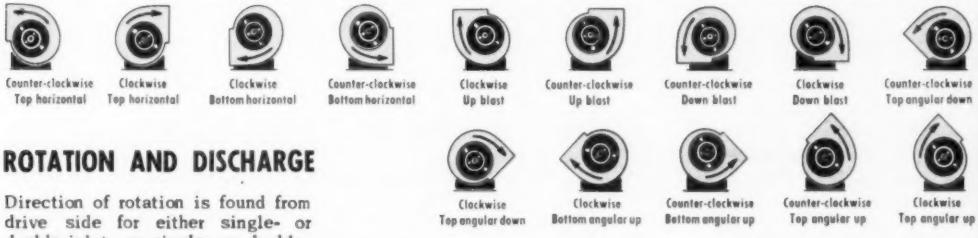
No. 3 SW SI: Belt or direct. Housing supports the bearings



No. 7 DW DI: Arr No. 3 with base for driver. Belt or direct

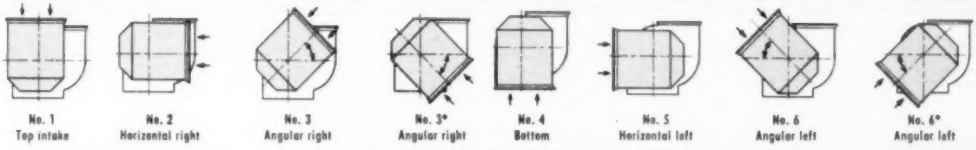
DRIVE DESIGNATION

NAFM has set up standard arrangements for fan drive, some of which are shown above. When ordering or referring to a fan, you can easily identify by number its drive arrangement, width and number of inlets. Thus *Arr No. 1 SW SI* means a belt- or direct-driven unit with overhung wheel, two bearings on base, single width *(SW)*, single inlet *(SI)*. *DW* and *DI* mean double width and double inlet, respectively



ROTATION AND DISCHARGE

Direction of rotation is found from drive side for either single- or double-inlet, or single- or double-width fans. Drive side of single-inlet fans is side opposite the inlet regardless of actual location of drive. For a fan inverted for ceiling suspension, direction of rotation and discharge is determined when fan is resting on floor. Designations above apply to all centrifugal fans



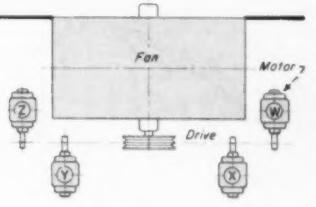
INLET-BOX DESIGNATION

Reference is horizontal line through center of fan shaft. Air-inlet entry is found from drive side of fan. With drives both ends of fan shaft, drive side is that with higher hp. For No. 3 and 6 boxes, give angle between centerlines as shown.

* May interfere with floor framing

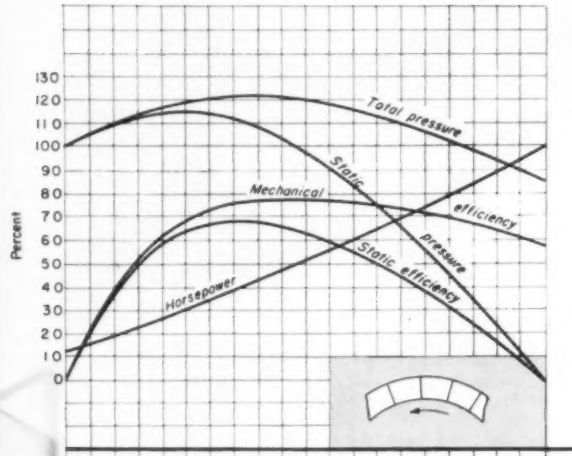
MOTOR POSITION

For fans with belt or chain drive, motor position is given as shown at right. Face drive side of the fan and designate motor position by letters *W*, *X*, *Y*, or *Z*, as the case may be. Use the data given on this page when ordering fans and in keeping plant records



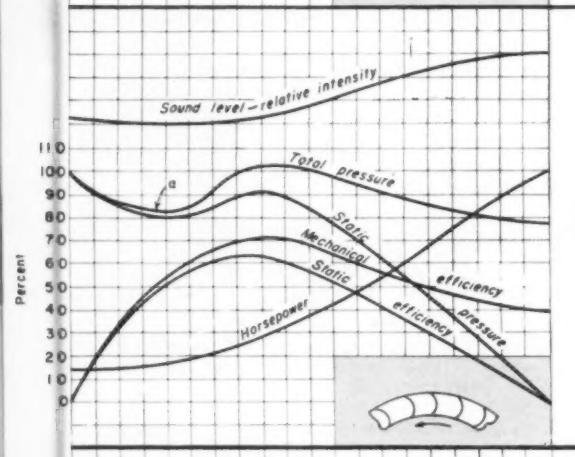
FAN CHARACTERISTICS

To aid in fan selection, characteristic curves plot fan pressure, horsepower, efficiency and noise level against air delivery rates ranging from no delivery



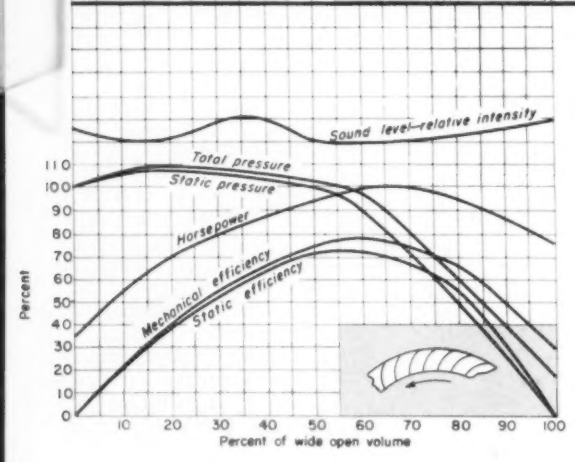
STRAIGHT-BLADE

Discharge pressure rises from free delivery (100%) to a maximum near no delivery (0%), where it falls off. Hp input increases with fan output. Maximum static efficiency occurs near maximum pressure



FORWARD-CURVE-BLADE

Fan pressure rises from free to no delivery with a drop, *a*, at low capacities. Maximum efficiency occurs at about maximum pressure. Horsepower input rises rapidly from no to free delivery. Sound is least at maximum efficiency and increases with higher velocity at free delivery



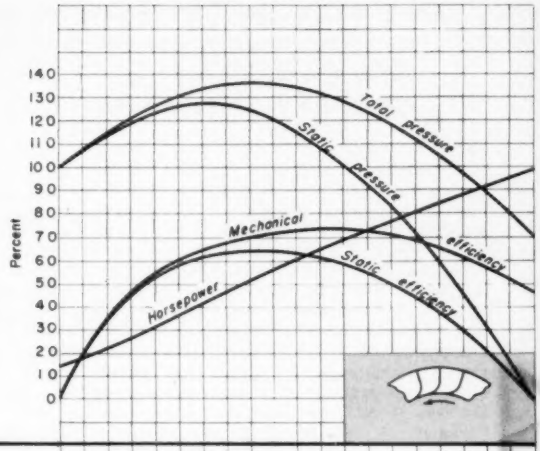
BACKWARD-CURVE-BLADE

Fan pressure rises from free almost to point of no delivery. Horsepower is self-limiting, rising to a maximum as capacity increases, then decreasing with additional capacity rise. Fan is more efficient at maximum hp; sound is least near this point, although it changes little with capacity

(damper closed) to free delivery (damper wide open). These curves are all on a percent basis and are typical for the type of fan or blade that is being considered

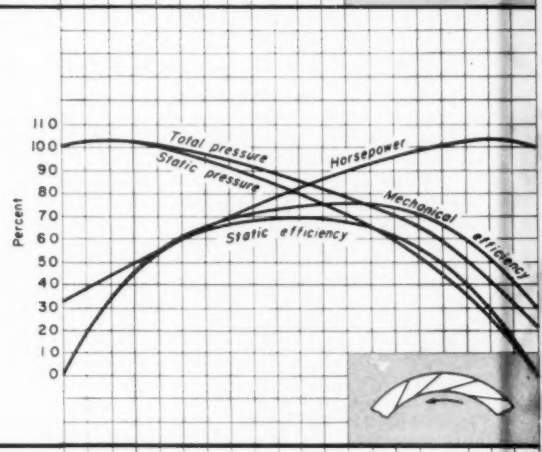
RADIAL-TIP-BLADE

Pressure and horsepower characteristics of this fan are similar to straight-blade units. But curved heel of blade can give better efficiency, permits using shorter blades operating at higher speeds. Shock losses at wheel entrance are lower than with straight-blade design



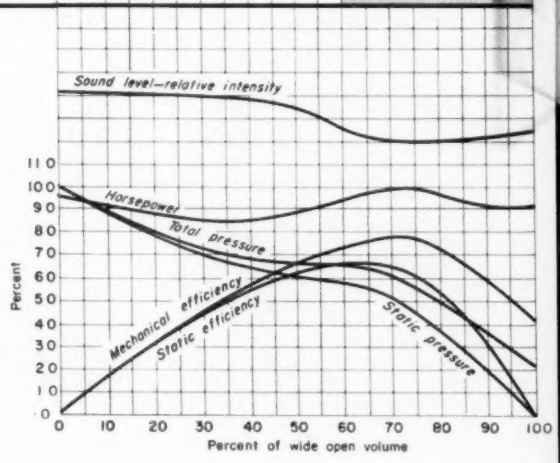
BACKWARD-FLAT-BLADE

These are a modification of backward-curve blades. Pressure characteristic doesn't have as steep a slope, horsepower curve hasn't as distinct a hump, maximum efficiency obtainable over wider range



AXIAL-FLOW

Depending on design, hp curve may be flat and self-limiting, as at right, or may fall from a maximum at no delivery as capacity increases. Type of guide vanes in vaneaxial fans measurably affects hp curve. Maximum efficiency occurs at higher percent delivery than with centrifugal fans



FAN CONTROLS

In many fan installations you must regulate output so air or gas delivered meets system needs. Summarized here are five ways to do this with advantages of each

Fan controls include dampers, inlet vanes and louvers, variable-pitch sheaves and drives of various types – fluid, magnetic, turbine, dc, slip-ring, and two- and three-speed ac motors. Controls are grouped in three classes: (1) constant fan and driver speed with a device to alter fan or system characteristic, (2) variable-speed driver directly connected to fan to give variable fan speeds, (3) fluid or magnetic drive, or other device, that gives variable fan speed with fixed driver speed.

DAMPERS. These throttle air or gas flowing to or from fan. Resistance produced by damper causes fan to operate at a higher pressure than needed by system, so capacity falls off. Look at any of the fan characteristic curves, p 94, and you'll see how a pressure increase is accompanied by fall in capacity for most of the range. Curve *A*, at right, shows general change of power input with air flow in a constant-speed fan fitted with a throttling damper. Air output is proportional to damper movement after initial partial closing of damper.

Dampers are best on fans with steep horsepower characteristics. Of controls used they have lowest first cost but require largest power input to fan. Simple to operate, they have wide-range regulation, may be either manually or automatically operated and are useful with less expensive standard constant-speed motors.

INLET VANES. Adjustable blades or vanes fitted to fan inlet can be set to give air a spinning motion in direction of fan rotation. This spin has same effect as a change of fan speed; new pressure and power characteristics are obtained. Excess pressure used with damper control is avoided. This reduces power needed to drive fan; operating cost is lower, curve *B*. First cost of inlet vanes is moderate, they have wide-range regulation, may be manually or automatically controlled.

INLET LOUVERS. These are often used with induced-draft fans. They give spinning motion similar to inlet vanes. Pressure and horsepower are affected in about the same way. Operating mechanism is outside duct, safe from high-temperature gas.

VARIABLE-SPEED DRIVERS. Not as common as other methods, these drivers may be motors or turbines. Dc motors are easily regulated down to about 35% of maximum speed. With slip-ring motors a speed reduction of about 50% can be made cheaply. Beyond this, additional controllers are needed, increasing cost and complication of the installation. Speed reductions are made in steps as in curve *C;* intermediate regulation is done by dampers unless suitable controllers are fitted. Multispeed ac motors give speed and capacity changes of two to three to one but some form of damper or vane control must supplement them so regulating range is sufficient.

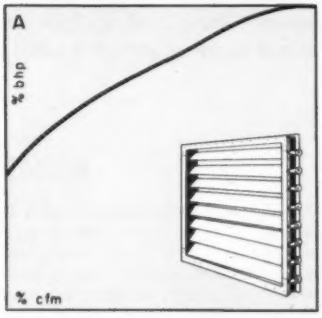
Steam turbines give good regulation of fan capacity down to about 35% of rated turbine speed. They are popular for heat balance in industrial plants. This type driver is often considered where exhaust steam is available for turbine or where turbine exhaust can be integrated in the plant heat balance.

VARIABLE-PITCH SHEAVES. These give speed and power changes suitable for many fans. Change may be made either manually or automatically while fan is rotating or at rest.

FLUID, MAGNETIC DRIVES. These have similar power characteristics, curve *D*. Stepless adjustable control with wide capacity range at low power input is obtained. First cost comparable to to variable-speed motors and turbines.

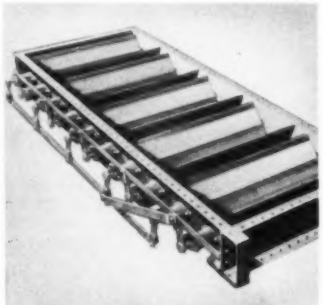
AXIAL-FLOW FANS. All these controls may be used with axial-flow fans. In addition, blades may be adjusted in some designs.

CURVES SHOW

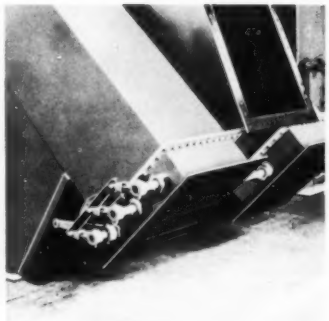


DAMPERS throttle air or gas flowing to or from the fan, are low-cost and simple

BELOW ARE

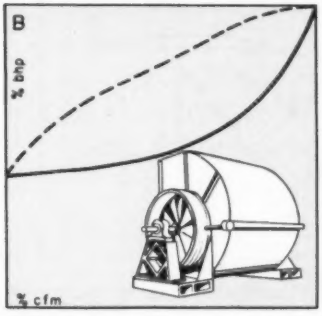


OUTLET DAMPER for very even throttling. Blades open, close in opposite directions

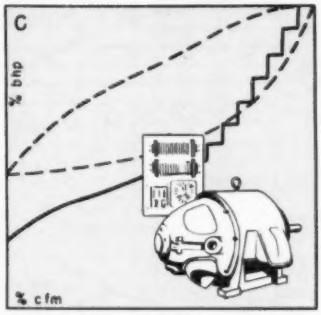


INLET LOUVERS on i-d fan. They are more efficient than dampers, give gas a "spin"

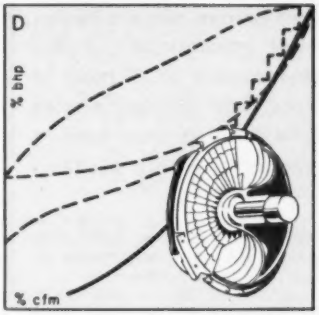
HOW POWER INPUT VARIES WITH CONTROL TYPE



INLET VANES and louvers give spin to air entering fan, don't waste static pressure

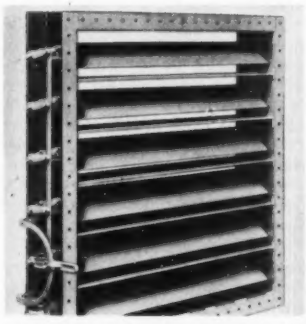


VARIABLE-SPEED drive, using a slip-ring motor, gives a stepped speed reduction

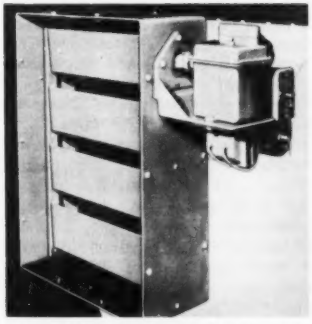


FLUID DRIVES and magnetic drives have like power curves, require least input

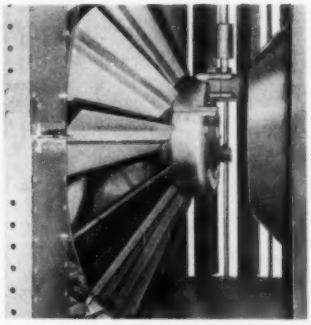
SOME CONTROLS USED IN PRACTICAL FAN WORK



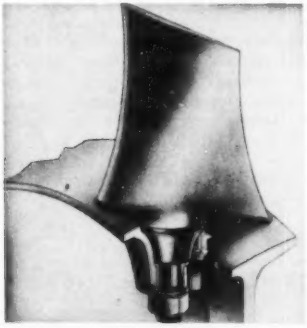
SPLITTER PLATES between damper blades give accurate control over entire range



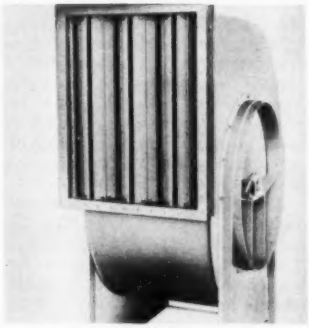
ELECTRICALLY OPERATED damper gives good volume control on constant-speed fan



INLET VANES installed in the fan inlet box are shown in their ¾ open position



ADJUSTABLE BLADE on vaneaxial fan gives wide pressure range, changes volume



DISCHARGE DAMPER on fan for ventilating or air conditioning gives good control

PORTABLE UNIT has adjustable number of openings to control air volume handled

FAN LAWS

Summarized here are the fan laws important in figuring performance of all types of fans. Text at right shows how to apply these laws to problems met in practice

Symbols: Q = air or gas volume, cfm; p = static, velocity or total pressure, in. H_2O; hp = horsepower input

1. CHANGE IN FAN SPEED
Air- (or gas-) density, system constant
(a) Q varies as fan speed
(b) p varies as fan speed squared
(c) hp varies as fan speed cubed

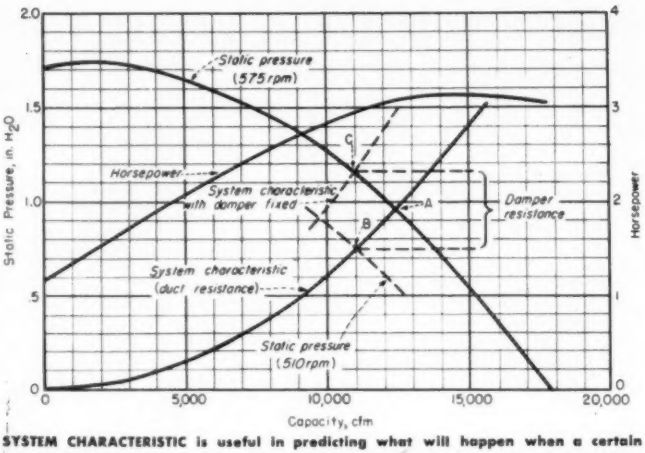
2. CHANGE IN FAN SIZE
Tip speed, air-density, fan proportions constant; fixed rating
(a) Q varies as square of wheel diameter
(b) p remains constant
(c) rpm varies inversely as wheel diameter
(d) hp varies as square of wheel diameter

3. CHANGE IN FAN SIZE
rpm, air-density, fan proportions constant; fixed rating
(a) Q varies as cube of wheel diameter
(b) p varies as square of wheel diameter
(c) *Tip speed* varies as wheel diameter
(d) hp varies as fifth power of diameter

4. CHANGE IN AIR DENSITY
cfm, system, fan speed constant; fixed fan size
(a) Q is constant
(b) p varies as density
(c) hp varies as density

5. CHANGE IN AIR DENSITY
Constant pressure and system; fixed fan size, variable fan speed
(a) Q varies inversely as square root of density
(b) p is constant
(c) rpm varies inversely as square root of density
(d) hp varies inversely as square root of density

6. CHANGE IN AIR DENSITY
Constant weight of air and constant system; fixed fan size, variable fan speed
(a) Q varies inversely as air or gas density
(b) p varies inversely as air or gas density
(c) rpm varies inversely as air or gas density
(d) hp varies inversely as air or gas density squared



SYSTEM CHARACTERISTIC is useful in predicting what will happen when a certain fan is connected to a known system. Effect of damper and speed reduction shown

Fan laws tell what happens to fan characteristic, p 94, when (1) speed is varied while external system remains the same, (2) when fan size is changed in geometric proportion while point of rating is fixed, (3) when air or gas density changes. The laws apply to all fans. (Size laws apply only to geometrically similar fans.) They're a useful tool.

USING LAWS. Easiest way to see how laws are applied is to solve some problems you're likely to meet.

EXAMPLE: Fan delivers 10,000 cfm at static pressure of 2 in. water when speed is 500 rpm, power input 6 hp. What's speed, static pressure, hp when fan delivers 14,000 cfm?

Solution: Laws in group 1 apply. So rpm = $500(14{,}000 \div 10{,}000) = 700$, SP = $2(700 \div 500)^2 = 3.92$ in., hp = $6(700 \div 500)^3 = 16.5$.

EXAMPLE: Fan delivers 8000 cfm at 70 F and normal barometric pressure (density 0.075 lb per cu ft) at a static pressure of 2 in. water when speed is 600 rpm, power input 5 hp. If air inlet temperature is raised to 300 F (density 0.0523 lb per cu ft) but fan speed stays the same, what is new SP, hp?

Solution: Use group 4 laws. Pressure = $2(0.0523 \div 0.075) = 1.4$ in., hp = $5(0.0523 \div 0.075) = 3.5$.

EXAMPLE: What speed must the above fan turn at to give a static pressure of 2 in. at 300 F? What will cfm and power be?

Solution: Use group 5 laws. Rpm = $600\sqrt{0.075 \div 0.0523} = 718$, cfm = $8000\sqrt{0.075 \div 0.0523} = 9585$, hp = $5\sqrt{0.075 \div 0.0523} = 6$.

SYSTEM CHARACTERISTIC. Many fans are connected to an external *system* (duct, air washer, furnace, etc) which imposes resistance on air or gas flow. Pressure needed to force air through system depends on cfm flowing. Like a fan every system has a certain relation between pressure and cfm; it can be plotted like fan characteristics and is called the *system characteristic.*

With a system of fixed resistance pressure needed varies as the square of the cfm and system characteristic has parabolic shape shown, independent of fan type.

Suppose we have a duct system that handles 11,000 cfm and needs 3/4 in. static pressure to maintain this flow. If we plot system and fan characteristics as above we find that but one condition of static pressure and capacity satisfies both fan and system. This is point *A*, intersection of the two pressure curves. It corresponds to 0.96 in. static pressure, 12,400 cfm, 3.08 hp, 575 rpm. To obtain exact flow needed (11,000 cfm, 3/4 in. SP) fan must be dampered or speed changed.

At 11,000 cfm and 575 rpm, fan pressure is 1.16 in., point *C*. So if we use a damper it must have a resistance equivalent to 0.41 in. at 11,000 cfm. Input, curve, is 2.95 hp.

If we reduce fan speed instead of dampering, 510 rpm satisfies condition, *A* moves back to *B*.

CENTRIFUGAL-FAN MULTIRATING TABLE

Wheel diameter = 60 in. Outlet area = 20.64 sq ft

Outlet velocity,	Capacity,	½ in. SP		¾ in. SP		1 in. SP		1½ in. SP		2 in. SP		3 in. SP	
fpm	cfm	rpm	hp	rpm	hp	rpm	hp	rpm	hp	rpm	hp	rpm	hp
1100	22,704	236	2.68	268	3.73	296	4.84	347	7.29				
1200	*24,768	246	3.05	276	4.16	303	5.37	352	7.89				
1300	26,832	256	3.48	285	4.66	312	5.91	359	8.56				
1400	28,996	266	3.96	294	5.21	320	6.51	366	9.30	407	12.2	483	18.8
1500	30,960	277	4.50	304	5.79	329	7.19	374	10.1	414	13.2	488	19.9
1600	33,024	288	5.10	314	6.45	338	7.91	382	10.9	421	14.2	493	21.2
1700	35,088	300	5.79	325	7.14	348	8.66	391	11.9	429	15.2	497	22.5
1800	37,152	312	6.53	336	7.95	358	9.51	400	12.8	437	16.3	505	23.6
1900	39,216	325	7.04	347	8.80	368	10.4	409	13.9	445	17.4	511	25.1
2000	41,280	338	8.30	358	9.75	379	11.4	418	15.0	454	18.7	519	26.6
2200	45,408	364	10.37	382	11.9	401	13.7	438	17.4	472	21.5	535	29.9
2400	49,536	391	12.80	407	14.5	425	16.2	459	20.2	493	24.4	553	33.4

VANEAXIAL-FAN RATING TABLE

All these fans turn at 1750 rpm

Fan dia,	.5 in. SP		1.0 in. SP		1.5 in. SP		2.0 in. SP		2.5 in. SP		3.0 in. SP	
in.	cfm	hp	cfm	hp	cfm	hp	cfm	hp	cfm	hp	cfm	hp
18	3260	.7	2900	.75	2500	.8						
22	5800	1.85	5400	1.9	4950	1.9	4250	2.0	3250	2.0	1850	1.85
25	8200	2.25	7750	2.65	7250	2.9	6750	3.05	6000	3.1	4500	2.9
25	10450	3.9	10000	4.1	9500	4.3	8950	4.5	8200	4.6	7000	4.4
29	13650	4.5	12800	4.65	11800	4.8	10750	4.95	9500	5.0	7700	4.9
29	15000	5.2	14300	5.7	13500	6.1	12700	6.5	11800	6.8	10900	6.9
29	17500	7.5	16800	7.7	16000	7.85	15100	8.0	14200	8.3	13150	8.4
32	17000	7.5	16400	8.0	15800	8.6	15200	9.0	14550	9.5	13900	10.0
32	22200	12.2	21600	12.5	21000	13.0	20400	13.4	19500	13.8	18700	14.1
34	29200	17.6	28450	18.4	27600	19.0	26800	19.6	25800	20.2	24800	20.8
36	31300	17.0	30500	17.8	29600	18.6	28600	19.4	27500	20.0	26700	20.6
36	40500	24.0	39200	24.5	38000	25.0	36400	25.0	34600	25.5	32800	26.0

FAN FIGURING for typical air-moving jobs

Multirating tables like that above left are often used in selecting a fan. Giving fan test results in convenient form, they are found in many catalogs. Here's how to use them.

EXAMPLE: Centrifugal fan for ventilation must deliver 33,000 cfm at 1 in. static pressure, 1600 fpm outlet velocity, What is rpm, hp?

Solution: From table, fan that most closely meets these conditions has capacity of 33,024 cfm. Since this is so close it may be used. Under 1 in. static pressure find rpm = 338, hp = 7.91

EXAMPLE: Centrifugal fan with a capacity of 40,000 cfm at 2½ in. static press. is needed. Find rpm,hp.

Solution: Nearest capacities in table are 39,216 and 41,280 cfm. For given conditions we must interpolate. At 2 in. pressure fan speed (rpm) is $445 + \left(\frac{40{,}000-39{,}216}{41{,}280-39{,}216}\right)(454-445) = 448$.

And the horsepower input is $17.4 + \left(\frac{40{,}000-39{,}216}{41{,}280-39{,}216}\right)(18.7-17.4) = 17.9$

Similar interpolation for same capacities at 3 in. pressure gives 514 rpm and 25.7 hp. Needed rating at 2½ in. is halfway between 2 and 3 in. or 40,000 cfm is delivered at 2½ in. pressure at a speed of 481 rpm and will require 21.8 hp.

Multirating tables are suitable for most selection problems. Always have manufacturer check choice.

VANEAXIAL FANS. Rating table, above right, is typical for vaneaxial fans. Tables for propeller fans are similar to this one but usually include a column for capacities at free delivery (no resistance).

EXAMPLE: Vaneaxial fan must deliver 15,000 cfm at 2 in. static pressure. What's hp, rpm?

Solution: Table shows that fan which delivers 15,100 cfm at 2 in. requires 8 hp, turns at 1750 rpm and has a 29-in. diameter.

As with centrifugal fans, you can make usual selections from manufacturer's rating tables. But for special jobs, such as fans in series, consult manufacturer.

FANS IN SERIES, PARALLEL. Flow of air through fans in series resembles flow of current in electric batteries. When low-pressure fans are in series weight of flow is about that of one fan, total pressure the sum of the total pressures of the fans that are connected in series.

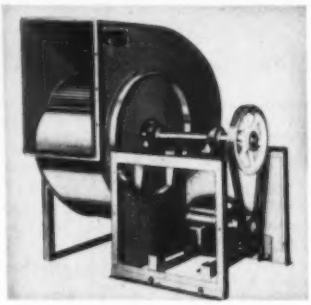
Electric-circuit analogy holds for fans in parallel too. Capacity is sum of individual capacities for a given static or total pressure.

RECOMMENDED FAN OUTLET VELOCITIES, TIP SPEEDS

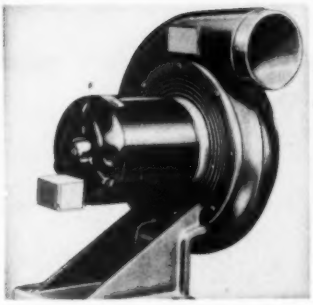
(For air conditioning, ventilation, heating — from ASHVE Guide, 1950)

Static Pressure, Inches of Water	FORWARD-CURVE BLADE FANS		BACKWARD-TIPPED AND DOUBLE-CURVE BLADE FANS		TUBEAXIAL AND VANEAXIAL FANS
	Outlet Velocity Feet per Minute	Tip Speed Feet per Minute	Outlet Velocity Feet per Minute	Tip Speed Feet per Minute	Wheel Velocity* Feet per Minute
1/4	1000–1100	1520–1700	800–1100	2600–3100	1100–1500
3/8	1000–1100	1760–1900	800–1150	3000–3500	1250–1700
1/2	1000–1200	1970–2150	900–1300	3400–4000	1400–1900
5/8	1200–1400	2225–2450	1000–1500	3800–4500	1500–2100
3/4	1300–1500	2480–2700	1100–1650	4200–5000	1650–2350
7/8	1400–1700	2660–2910	1200–1750	4500–5300	1800–2500
1	1500–1800	2820–3120	1290–1900	4800–5750	1900–2700
1-1/4	1600–1900	3162–3450	1300–2100	5300–6350	2150–3000
1-1/2	1800–2100	3480–3810	1400–2300	5750–6950	2350–3300
1-3/4	1900–2200	3760–4205	1500–2500	6200–7550	2500–3550
2	2000–2400	4000–4500	1600–2700	6650–8050	2700–3800
2-1/4	2200–2600	4250–4740	1700–2800	7050–8550	
2-1/2	2300–2600	4475–4970	1800–2950	7450–9000	
3	2500–2800	4900–5365	2000–3200	8200–9850	

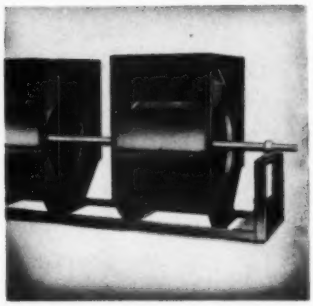
*Wheel velocity is axial mean air velocity through inside diameter of housing cylinder at point of wheel location.



BELT-DRIVEN unit for ventilation has the motor and drive assembly exposed



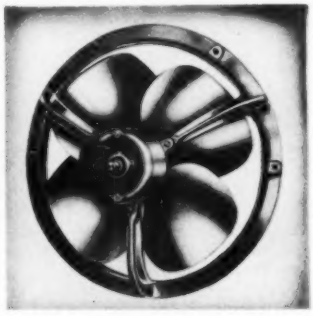
HIGH-PRESSURE centrifugal fan removes dust, conveys, exhausts or supplies air



TWO-FAN UNIT, belt-driven, is suitable for many industrial and commercial jobs

ROOF VENTILATOR uses centrifugal fan, exhausts air, fumes from building ducts

VANEAXIAL, belt-driven, handles air, gas or fumes for a variety of ventilation jobs



PROPELLER FAN may be fitted with a shutter for weather protection of unit

AIR CONDITIONING, VENTILATION

Fan calculations on two previous pages are typical. Besides this "figurin'," which includes cfm moved, static pressure needed, power input, rpm and density of air handled, we must know: (1) fan efficiency, (2) space occupied by fan, (3) fan sound emission, (4) type of driver, (5) fan arrangement, p 93. Depending on job, the space occupied, power consumption or sound emission of fan may be of first importance.

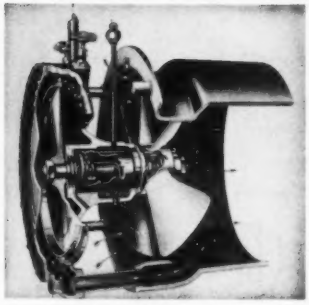
SOUND. In many plants sound must be kept at a minimum. Fans operate most quietly when at or near their maximum static efficiency. So multirating tables that show points of maximum efficiency are helpful in picking fans that will make least noise. Fans chosen so they fall in the ranges listed in table at bottom of preceeding page have low noise level and power consumption. Also, you can find relative noise level on some characteristic curves, p 94.

CENTRIFUGAL OR AXIAL-FLOW? This is biggest question you first meet. There isn't a fixed answer; job conditions influence every choice. Not only that, there are many jobs where either type gives fine results.

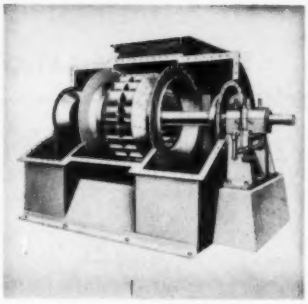
Centrifugal fans are most commonly used for large central air-conditioning and ventilating systems. Propeller fans find wide use in space ventilation where air must be moved at low pressure or free delivery conditions. For general ventilation, as in offices, kitchens, restaurants, etc, either centrifugal or axial-flow fans may be used. Likewise, both these types are applied for fume exhausting, blowing and similar services. Axial-flow fans are common for cooling towers, radiators and jobs needing portable fans. The general trend in recent years has been for wider use of axial-flow fans, particularly vaneaxial units. As a result we find an overlapping of fan applications.

BLADE SHAPE. Straight, forward-curve, radial-tip or backward-curve blades may be used. Forward-curve fans take least space for given capacity, may turn at a higher rpm than straight-blade units. Radial-tip and backward-curve fans need more space but are well suited for high speeds and parallel operation. Also, backward-curve blades operate extremely quietly.

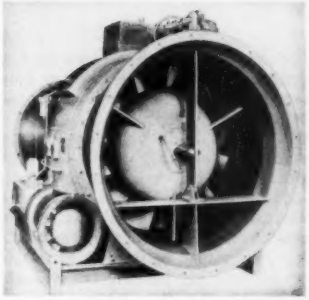
Blade shape also affects axial-flow fan performance but differences are not as clearly defined as for centrifugal fans. A better guide is fan type. In pressure range covered by axial-flow units, lower end is often served by propeller fans. Tube-axial fans give good service on medium-pressure jobs, vaneaxials on high-pressure jobs. Of course there is a certain amount of overlap but the best way to find if a particular unit is suited for your conditions is by study of it.



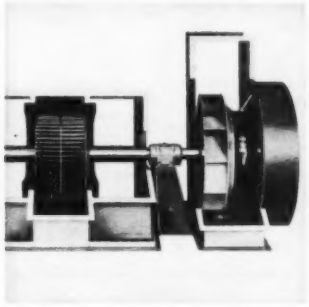
FORCED-DRAFT turbine-driven blower supplies air needed for combustion of fuel



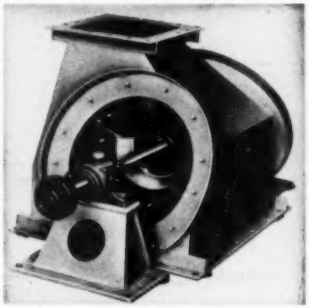
INDUCED-DRAFT FAN, DW, DI, has inlet box each side of wheel, radial-tip blades



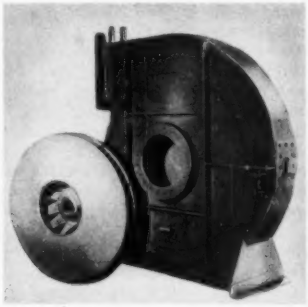
VANEAXIAL f-d fan with variable-pitch blades; low powered, easily controlled



DUPLEX ASSEMBLY has i-d and f-d wheels on the same shaft, driven by fluid drive



FAN STACK base showing rotor, one half of split inlet cone, bearing, coupling



PRIMARY-AIR FAN for pulverized-fuel system blows air and coal into furnace

FORCED AND INDUCED DRAFT

Calculations for mechanical-draft fans resemble those on previous pages. Note that flue-gas density is different from that of air.

SPECIFICATIONS. Include these data for fan selection: (1) cfm or cfh of air or gas (2) temperature and density of air or gas (3) static pressure at fan inlet (4) static pressure needed at outlet (5) driver type (6) hours operated per year. Check with manufacturer for other data he may need in selection.

WHAT TYPE? Backward-curve centrifugal fan is often chosen for standard f-d use. It meets four important requirements: reserve pressure (steep head characteristic), good efficiency, high speed and ability to operate in parallel. Some f-d fans have backward double-curve blades, others that handle preheated air have forward-curve blades. Independent pedestal bearings are common on mechanical-draft fans.

Axial-flow fans are also popular for f-d. Propeller, tube- or vaneaxial units are used. Drive is turbine or motor, depending on conditions.

INDUCED DRAFT. Forward, back, straight and radial-tip blades give good service on i-d. For high static pressures a forward-curve fan with inlet boxes is practical because its capacity is high for given size while tip speed is low. Straight-blade wheels have few blades, low speed and can be used in parallel. Radial-tip wheels have good efficiency, moderate speed and small size for given capacity.

Some special forms of i-d fans include stack-supporting units, cinder-eliminating fans, duplex assemblies with f-d and i-d wheels on same shaft, wheels fitted with blade liners to take wearing action of abrasive gas, and fan stacks – units that combine fan, breeching and an evacuating stack. Other i-d fans have water-cooled shafts.

In one cinder-eliminating fan there are slots in scroll housing through which dust and dirt are removed. Hoppers can be fitted to fan inlet housings and dust collected returned to furnace.

Fan stacks are of various designs. In some, fan handles all gas, discharging it into a cone-shaped stack. In others a fan discharges clean air into stack fitted with a venturi section. Suction draws gas into stack from where it flows to atmosphere. Fan handles only clean air. Where gas isn't too abrasive fan may handle small amount of it or a mixture of air and gas. Efficiency is higher when handling all gas or a gas-air mixture than when handling air alone. Some fan stacks have dust collectors.

PRIMARY-AIR FANS. These supply air for combustion and blow coal into furnaces of pulverized-coal boilers. They are often narrow units with straight blades, produce high air pressure required.

MAINTENANCE

Sketches at right give hints on fan installation. Study them before putting a new fan in or relocating an old one.

STARTING. Unless bearings have enough lubricant, are properly aligned and dust-free, you may have starting troubles. Where air or gas temperature is 250 F or over, water cooling of bearings is often used. See that water is flowing (5 to 10 gal per hour per bearing is needed).

Before starting, shut dampers, vanes, etc. After fan is rolling adjust controls for needed pressure or draft. If fan vibrates much stop unit immediately to find cause. Watch for overheated bearings.

STOPPING. Shut down driver according to instructions. If fan has vane control and/or dampers, close. Let water circulate through water-cooled bearings until they're cool.

LUBRICATION. Oil or grease regularly. Don't add too much. Flush dirty bearings with kerosene or mineral oil; refill after cleaning.

A highly-refined uncompounded mineral oil of proved oxidation resistance is often recommended. Table gives typical viscosities.

Air temp around bearing, F	SSU viscosity at 100 F
32-90	300-350 (SAE 20W)
90-150	500-600 (SAE 30W)
Above 150	750-1100 (SAE 50-60W)

VIBRATION. Fans running unbalanced get steadily worse, can have serious trouble like burning out bearings, weakening their supports, loosening piping, springing shaft or damaging wheel. Some causes of unbalance are wear, misalignment, weak foundations, bent shaft, worn bearings and dirt on rotor blades.

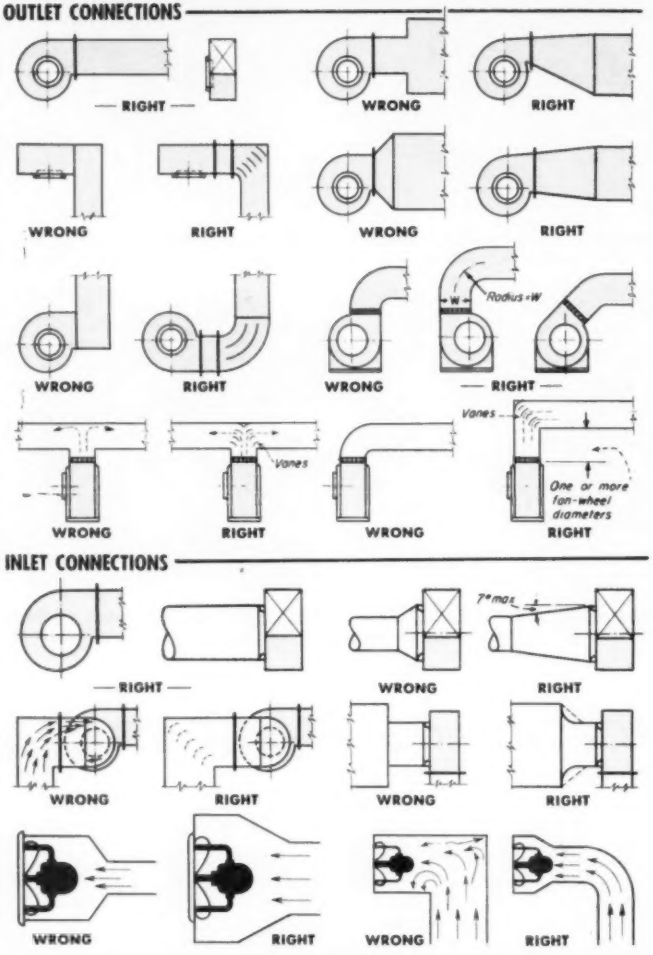
Measure amount of unbalance with a vibration meter — mechanical or electrical. There aren't any fixed rules on allowable vibration but table below gives average guide.

Fan speed, rpm	Vibration displacement, mils, Smooth	Fair	Rough	Very Rough
600	2	4	8	15-20
900	1.5	2.75	6	8-10
1200	1.0	2	4.5	6-8
1800	0.75	1.5	3.5	5-7

FAIR isn't bad but should be improved; balance ROUGH as soon as possible; VERY ROUGH — don't operate

Lastly, clean fan regularly; paint where needed.

SOME INSTALLATION DO'S AND DON'TS



ACKNOWLEDGEMENTS

Power is indebted to the following manufacturers for supplying general information, technical data and illustrations used in preparing this special section: Aerovent Fan Co; American Blower Corp; Arex Co; Bayley Blower Co; Harvey P Bertram Co; Buffalo Forge Co; Burt Mfg Co; E K Campbell Heating Co; Chelsea Fan & Blower Co, Inc; Clarage Fan Co; Cappus Engrg Corp; DeBothezat Fans Div — American Machine & Metals, Inc; DeVilbiss Co; Diehl Mfg Co; Fly Ash Arrestor Corp; Foster Wheeler Corp; Fluor Corp, Ltd; General Blower Co; Green Fuel Economizer Co; Hartzell Propeller Fan Co; Herman Nelson Div — American Air Filter Co, Inc; ILG Electric Ventilating Co; Jeffrey Mfg Co; Joy Mfg Co; Koppers Co, Inc; Marley Co; The Moore Co, Inc; Niagara Blower Co; Prat-Daniel Corp; J F Pritchard & Co; Ripley Co, Inc; Robbins & Myers, Inc; Swartwout Co; South Bend Air Products, Inc; B F Sturtevant Div — Westinghouse Electric Corp; The Thermix Corp; The Trane Co; Westinghouse Electric Corp; C H Wheeler Mfg Co; L J Wing Mfg Co.

This supply line is geared for your stepped-up production

AMERICA REARMS. This rearmament program undoubtedly means that your plant has, or will have, a greatly stepped-up production schedule. And with new machines and new operations, new lubrication problems are created.

That's where we come in. A Standard service-supply center is near your plant. Any petroleum product you need can be delivered to your door within a few short hours. You need never worry about production delays, and you can avoid the expense of stocking large supplies of lubricants and fuels within your plant.

Your nearby Standard service-supply center is your always-dependable Supply Line. It is also headquarters for a Standard lubrication specialist, a man specially trained to give you expert and thorough advice on any lubricating problem, is also available through this service-supply center. His services, along with Standard Oil's efficient supply service, can help your important production go like clockwork.

To arrange for a visit from your nearest lubrication specialist, phone your nearby Standard Oil service-supply center or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

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● Without a protective coating, these ground finish steel tubes showed rust marks even before the customer could assemble them. A heavy black oil type coating proved difficult and messy to apply, resulted in an unattractive product, and called for a cleaning operation on the part of the customer.

That was the situation at Central Steel Tube Co., Clinton, Iowa, when a Standard Oil lubrication specialist recommended STANORUST Rust Preventive No. 4-V. Tested and approved, STANORUST was put to work.

Now, these same parts are easily and automatically sprayed after grinding. STANORUST No. 4-V leaves a slightly oily, transparent coating that shows the ground finish to advantage, yet allows handling of the parts without fear of fingerprint corrosion. Shipped to the customer, they arrive bright and rust-free, ready for assembly without removal of the protective coating.

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Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Ill.

What's your problem?

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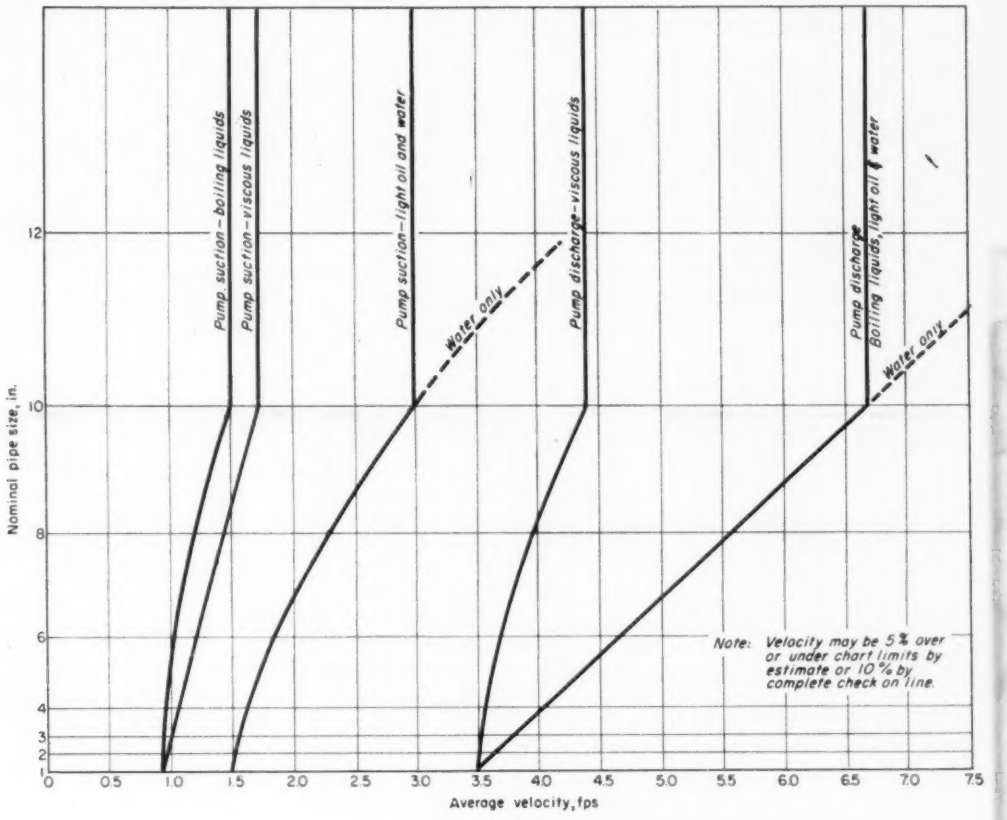
STANOIL Industrial Oils—This multi-purpose line of oils provides cleaner operation of hydraulic units, supplies effective lubrication in compressors, gear cases, and circulating systems. One or two grades can replace a wide variety of special oils and lubricants.

SUPERLA Greases—Available in lime soap and soda soap types, SUPERLA Greases cover a wide range of applications. These products are comparable in quality to the highest type of special greases but are as readily available and economical as ordinary cup greases.

STANDARD OIL COMPANY STANDARD *(Indiana)*

POWER'S DATA SHEET

NUMBER 232



Allowable Pipe Velocities for Liquids

► THIS CHART has been developed from extensive experience in sizing liquid lines of a length usually adopted within processing plants. Many installations show that certain velocities must be used to insure good flow conditions and reasonable pressure-drop allowances making an efficient layout.

Liquids differ greatly. For instance, compare bunker C oil, kerosene, gasoline, water, etc. Where you're likely to meet cavitation in a pump, exceptionally low velocities must be used on the suction side. Liquids close to their saturation temperature, that is "boiling" liquids like water, liquid CO_2, and ammonia, must approach pump suctions slowly and with little turbulence or else they will flash to vapor.

Once liquids are under pressure on the discharge side of pumps, higher pipeline velocities can be used without trouble. All the curves, above, break at the 10-in. line size. The exception is for water on two of the curves, which is indicated by the dashed lines.

J D CONSTANCE *Cliffside Park, N. J.*

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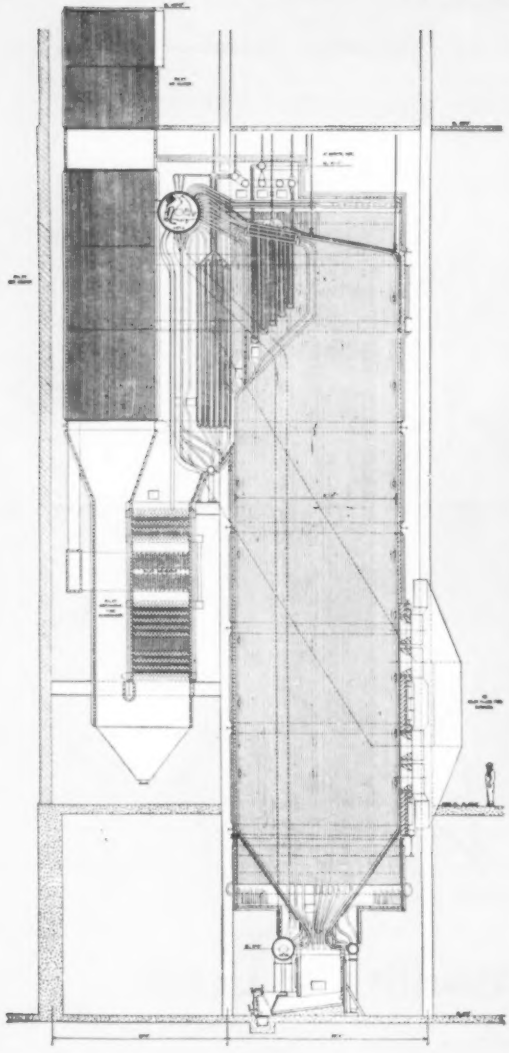
This is the fifth Riley Unit



Central Illinois Light Company

R. S. WALLACE STATION
E. Peoria, Illinois
Commonwealth Services Inc., Engineers

Capacity	600,000 lbs./hr.
Design Pressure	950 psig.
Steam Temperature	900°F.
Exit Gas Temperature	325°F.
Air Temperature	645°F.
Efficiency	86.5%
Pulverized Coal and Gas Fired	
Coal	
Central Illinois Strip Mine	
Moisture	20%
Volatile	31.2%
Fixed Carbon	34.4%
Ash	14.4%
B.T.U.	9000
Fusion Temperature	1900-2000°F.
Sulphur	3.2%
Heat Balance	
Dry Gas Loss	5.02%
Hydrogen and Moisture Loss	6.16%
Moisture in Air Loss	0.12%
Unburned Combustible Loss	0.40%
Radiation Loss	0.30%
Manufacturer's Leeway	1.50%
Total Losses	13.50%
Efficiency of Unit	86.5%

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
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Salt Lake City · Los Angeles · Portland · Seattle

BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · FLUE GAS SCRUBBERS

for the R.S. Wallace Station

Central Illinois Light Company ordered their first Riley Steam Generating Unit in November 1936—a second unit in July 1939—two additional units in July 1945 and the latest unit, which is now being installed, a 600,000 lbs./hr. Riley unit, in November 1948. Making a total capacity of Riley units in the R. S. Wallace Station of 1,800,000 lbs./hr. All steam generating units purchased since 1936 for this station have been Riley units.

This is a typical case. Users of Riley equipment almost invariably order additional Riley units when expanding their facilities. Following is a partial list of public utility companies who have repeatedly ordered Riley units:

Public Service Company of Indiana	**7 units**
Iowa-Illinois Gas & Electric Co.	**6 units**
Interstate Power Company	**7 units**
South Carolina Gas & Electric Co.	**3 units**
Central Ohio Light & Power Co.	**5 units**
Houston Lighting & Power Co.	**9 units**
Gulf Power Company	**3 units**
Utah Power & Light Co.	**4 units**
Otter Tail Power Co.	**7 units**
Mississippi Power Co.	**3 units**

Users come back for more Riley units not only because of the reliability, economical operation and continuity of operation of Riley equipment, but also because of the manner in which Riley handles details during the various stages of the contract—engineering, production and erection—and because of the service co-operatively rendered after years of operation. Users have learned they can rely on Riley and that it pays to investigate Riley equipment before purchasing steam generating or fuel burning equipment. It will pay you to do so.

All of these public utilities have ordered Riley Steam Generating Equipment:

THE POTOMAC EDISON CO.	
Albright Station	1–700,000 lbs./hr.
IOWA ELECTRIC LIGHT & POWER CO.	
Boone Station	1–275,000 lbs./hr.
NORTHERN STATES POWER CO.	
Granite Falls Station	1–385,000 lbs./hr.
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY	
Moncks Corners Station	2–460,000 lbs./hr.
MONONGAHELA POWER COMPANY	
Albright Station	1–700,000 lbs./hr.
SUPERIOR WATER, LIGHT & POWER CO.	
Superior Station	1–125,000 lbs./hr.
HOUSTON LIGHTING & POWER CO.	
Gable Street Station	1–140,000 lbs./hr.
Gable Street Station	1–250,000 lbs./hr.
Gable Street Station	1–350,000 lbs./hr.
Greens Bayou Station	2–675,000 lbs./hr.
West Junction Station	2–400,000 lbs./hr.
West Junction Station	2–825,000 lbs./hr.
PUBLIC SERVICE CO. OF INDIANA	
Dresser Station	1–300,000 lbs./hr.
Edwardsport Station	3–400,000 lbs./hr.
Noblesville Station	3–300,000 lbs./hr.
NORTHERN VIRGINIA POWER CO.	
Riverton Station	1–350,000 lbs./hr.
CENTRAL ILLINOIS LIGHT CO.	
R. S. Wallace Station	1–600,000 lbs./hr.
R. S. Wallace Station	4–300,000 lbs./hr.
ARKANSAS POWER & LIGHT CO.	
Cecil Lynch Station	1–650,000 lbs./hr.
UTAH POWER & LIGHT CO.	
Orem Station	1–450,000 lbs./hr.
Jordan Station	1–620,000 lbs./hr.
Jordan Station	1–575,000 lbs./hr.
WORCESTER COUNTY ELECTRIC CO.	
Webster Street Station	1–325,000 lbs./hr.
WEST PENN POWER CO.	
Milesburg Station	2–210,000 lbs./hr.
INTERSTATE POWER CO.	
Dubuque Station	1–200,000 lbs./hr.
Lansing Station	2–120,000 lbs./hr.
Fox Lake Station	2–120,000 lbs./hr.
Clinton Station	1– 45,000 lbs./hr.
NEW ORLEANS PUBLIC SERVICE CO.	
Market Street Station	1–330,000 lbs./hr.
IOWA-ILLINOIS GAS & ELECTRIC CO.	
Riverside Station	3–250,000 lbs./hr.
Coralville Station	1– 60,000 lbs./hr.
Moline Station	2–200,000 lbs./hr.
CITY OF LOS ANGELES	
Harbor Steam Station	3–825,000 lbs./hr.
Harbor Steam Station	2–675,000 lbs./hr.
MISSISSIPPI POWER CO.	
Plant Eaton	3–230,000 lbs./hr.
OTTER TAIL POWER CO.	
Kidder Station	2–100,000 lbs./hr.
Crookston Station	2– 75,000 lbs./hr.
Devils Lake Station	1– 75,000 lbs./hr.
Canoy Station	1– 75,000 lbs./hr.
OHIO EDISON CO.	
Mad River Station	1–250,000 lbs./hr.
SOUTH CAROLINA POWER CO.	
Plant Hagood	2–230,000 lbs./hr.
Plant Hagood	1–900,000 lbs./hr.
GULF POWER CO.	
Pensacola Station	2–230,000 lbs./hr.
Pensacola Station	1–325,000 lbs./hr.
UNION ELECTRIC CO. OF MISSOURI	
Ashley Street Station	2–285,000 lbs./hr.
Ashley Street Station	3–310,000 lbs./hr.
CENTRAL OHIO LIGHT & POWER CO.	
Woodcock Station	2–120,000 lbs./hr.
Woodcock Station	1– 90,000 lbs./hr.
Woodcock Station	2– 60,000 lbs./hr.
PENNSYLVANIA ELECTRIC CO.	
Williamsburg Station	1–300,000 lbs./hr.
CAROLINA POWER & LIGHT CO.	
Moncure Station	2–330,000 lbs./hr.

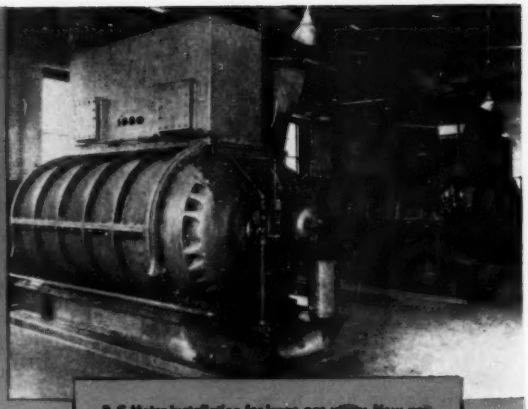
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

YOU CAN ALWAYS trust R-C METERS



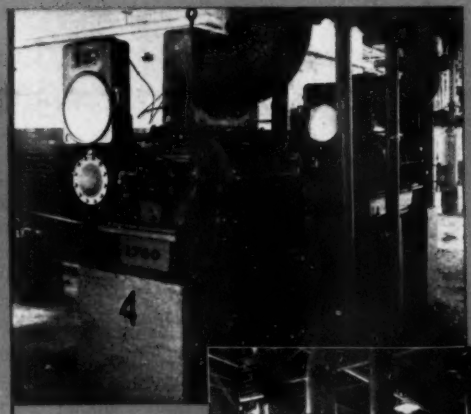
R-C Meter installation for large gas utility. New unit, in front, has capacity of 1,000,000 cfh. Two older meters, in background, have been in use for years.

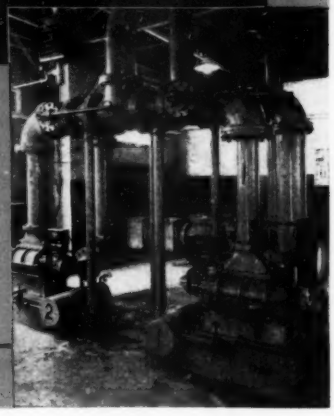
If you're measuring gas for production processes, you can't take any chances on quantities. If you are buying or selling it, you need cash register accuracy. You want equal precision for departmental cost accounting.

The permanent accuracy of R-C Positive Displacement Meters has long been proved for all these purposes by manufacturers and utilities which buy, sell and use gas. Four important reasons account for this unvarying reliability:

1. Accuracy is not affected by variations in specific gravity, rate of flow, pulsation, moisture, impurities or uncontrollable factors.
2. Accuracy is not subject to adjustment of meter or recorder by operators or other persons.
3. Accuracy is not affected by reasonable overloads.
4. Accuracy is permanent because measuring chambers are surrounded by precision-machined, cast iron surfaces.

The 31 standard sizes of R-C Meters give capacities from 4,000 cfh to 1,000,000 cfh. They are extremely compact, permitting installation in cramped spaces. Indicating and recording instruments are available for all types. For whatever purposes you measure gas, you can permanently depend on R-C Meters. Ask for Bulletin 40-B-14 or write us your specific problem.





Part of an installation of nine R-C Meters in large processing plant, measuring acetylene gas sold to nearby manufacturers. They also use R-C Meters on receiving ends. Capacities range from 3,000 cfh to 130,000 cfh.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Powell Ave.,
Connersville, Indiana

ROOTS-CONNERSVILLE
BLOWER BUILDERS SINCE 1854
ONE OF THE DRESSER INDUSTRIES

PLANT OPERATION and MAINTENANCE SECTION

OCTOBER 1951

'YOUR BABY, AL'

says Chief Engr Mike Yunich of Cleveland Graphite Bronze Co to Al Baker.

Does this large air compressor sparkle? You bet it does, and it purrs like a kitten, too. Mike got the bright idea of assigning each machine to an assistant and sticking his name on it.

What happened? You won't find cleaner or better-working machinery anywhere. Everyone tries to outdo the next guy. Come to think of it, it's this spirit of competition that keeps America out-producing Joe Stalin's entire red world

Try These Money-Saving Tips in Your Plant

Here are seven maintenance hints that may pull you out of a hole—or keep you from getting into one. Whether you repair a turbine casing, stop a boiler leak, grind taper plug cocks or identify metal at a glance, do it safely. For working sketches and complete 'how to' text, turn the page . . .

SAFETY HAT keeps this boilermaker living on borrowed time, to work again

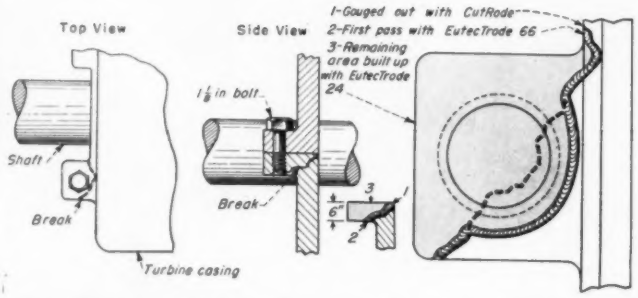
HAT PIN is not 'head pin' because of this safety hat made of plastic

Louis D'Amico, boilermaker at Aliquippa Works of Jones & Laughlin Steel Corp, can thank his safety hat for being alive. This drift pin shot 30 ft from top of a blast furnace and struck his hat.

The heavy pin drove into the laminated plastic skullguard but was stopped short of D'Amico's head. The hat's inside cradle lining was adjusted just right. It allowed one and a quarter inch clearance between the hat's top and his head.

So what? Before tackling any maintenance job, take all precautions. Goggles, safety hats, other equipment can't help *if you don't wear them.*

PUT THESE 7 TESTED...



LOW-TEMPERATURE welding gets ship out to sea after ten days of failure of various welding methods on turbine casing. Weld still holds good after four years

SHIP'S TURBINE REPAIR. Low-hydrogen electrode helps the ship sail after many failures

The large passenger liner *SS Brazil* was loaded and ready to sail. Then a cracked boss was found on the starboard steam-turbine casing. A piece had completley broken out, see sketch. The turbine was 8500 hp at 275 psi. What to do?

For ten days all kinds of welding jobs were tried. But each time the one and one-eighth inch capscrew was tightened, the welded boss snapped. That's when I was called in.

Here's how I did the job:

Step 1—The break was right through the tapped hole. That meant final deposit required full machinability. I used CutTrode to gouge out a small area past the hole.

Step 2—Next I deposited a preliminary layer of EutecTrode 66 along the entire break surface. Reason for using EutecTrode 66 is that it yields an excellent bond on "dirty" oil-soaked cast iron, and forms an ideal base for EutecTrode 24.

One reason so many welding rods failed for ten previous days was that turbine had been in operation for over 20 years. Casing was thoroughly oil and water soaked. Then when welding, the arc's heat generated hydrogen gas. This gas bubbles up through the molten weld metal, causing porosity and a very weak bond. Because EutecTrode 66 is a low-hydrogen electrode, and applied after first gouging with CutTrode to burn out the oil and moisture in the casting, it works under these tough conditions.

Step 3—I built up the remaining break area with EutecTrode 24, which is fully machinable. Then we drilled and tapped the hole right through the weld. I did that job four years ago. The turbine is still in operation and her chief engineer is really pleased.

Time to repair casting: about five hours.

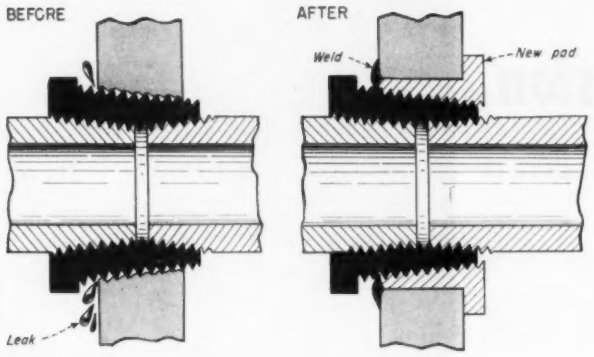
Welding alloy used: about 20 lb of EutecTrode 24, 5 lb of EutecTrode 66, and a few CutRodes.

FRANK ROMANO *Flushing, N. Y.*

NEW ELECTRONIC TORCH cuts the firebrick

A new electronic torch has been developed by GE Research Laboratories that cuts holes through tungsten and firebrick. Dr J D Cobine says the torch flame is 9 in. long and melts these two hardest-to-melt elements. To give you an idea, tungsten melts at 6097 F. Is that enough heat to do your tough jobs?

...IDEAS TO WORK FOR YOU



THREADS LEAKED on this boiler feed-line bushing. After many attempts, inspector suggested welding in new pad so bushing had new full threads. No more leak now

BOILER LEAK STOPPED. Have you tried welding in new threaded collar?

Our hrt boiler gave trouble by leaking around the feed pipe bushing in front head. Head is 9/16 in. thick and tapped for standard 2-in. steel bushing of 11½ threads per inch. Threaded bearing is about 6½ threads.

It had been fixed before, but leaked several times. We always removed the bushing and cleaned up threads with pipe tap. Then we put in a new bushing, well "doped." But soon it would start to "weep" and gradually get worse, until it had to be done over again. That was a headache.

Last time this happened, the bushing threads were very bad. The insurance inspector ordered the threads burned out, sketch, and a pad welded in to give full threads for pipes. We took a regular blowoff pad and faced it off to come flat against heads, with hub projecting through to front side. Then it was arc-welded to head. This made an excellent job and solved our problem.

There should be many places where this idea can be used.

A H MOULTON *Pittsfield, Mass.*

KNOW YOUR METAL. Color and shape of the sparks put you on the right track

Here's a quick, rough test to show what kind of metal you are working with. It also helps tell hardness. Hold metal against spinning grinder wheel and note color of sparks.

Light straw—wrought iron or mild steel

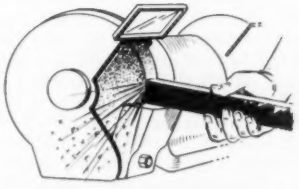
White—carbon steel, tool steel or manganese iron or steel

Chrome yellow—high-speed steel

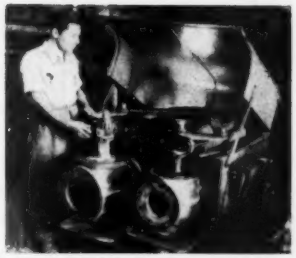
Orange—ordinary magnet steel

This is an old test, but it's fairly reliable in a pinch.

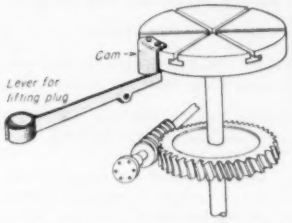
C M JONES *New York City*



SPARKS from metal give you rough idea of the material before you machine it



GRINDING PLUGS is easy with home-made machine. It grinds two at a time



LEVER and cam lift plug so the grinding compound does not build up in lump

PLUG GRINDER.

Mechanical grinder saves skilled labor in Chile

In our plant we have many 3, 4, 6 and 8 in. tapered cocks for various services. To keep cocks tight, they must be ground in right.

Because weight of large cocks made grinding a tiring and slow job, we built grinding rig shown in photo. It grinds two cocks at a time.

Remove cock and body from line and bolt onto machine. Coat tapered plug lightly with grinding compound and place back in cock body. Bolt ratchet wheel onto stem and hook up to bell crank, made from lathe surface plate.

Plate has cam bolted to under side for lifting plug out of body. Lifting prevents compound building up in one area. Lifting plug and grinding back and forth only about a quarter turn each time is secret of grinding plugs.

Sketch shows arrangement of worm and wheel connected to electric motor, also lever and cam. It's only necessary to set the machine up and push motor button.

Wipe compound off, and coat plug with oil so machine gives plug an "oil rub." That cleans compound out of metal and puts a shiny finish on plug and seat.

J P RAMIREZ *Tocopilla, Chile*

These Five Steps Help Prevent Furnace Explosion

1 Get competent firemen, instruct them properly on equipment and controls. They're your first line of defense

2 Follow lighting-off procedure, below, faithfully

3 Provide good-sized inspection window so lighting torch, pilot, main burner flame, flame rod, if used, can be easily seen

4 Set up periodic inspection and maintenance program as follows (Include checking fuel-air ratio, draft adjustments, pilot flame settings):
Test safety shutoff fuel valves for tight shutoff
See how combustion safeguard responds to loss of flame contact
Test fan interlocks
Keep test records for insurance inspector's review

5 Get the insurance company's approval in advance for new installations or proposed changes. Submit plans showing burners, fuel piping, draft fans

LIGHTING-OFF TIME for oil- or gas-fired boilers represents a danger period for possible furnace-explosion build-ups

► THERE ARE REALLY only two danger periods when oil- or gas-fired furnaces can explode. These periods cover a good share of the time when a boiler should be getting the most attention. They begin with lighting off, and carry over to light-load firing. But they can happen only when there has been a build-up to dangerous proportions of unburned fuel or flammable products of incomplete combustion.

According to one insurance company's* findings 87% of all boiler furnace losses for a 13-year period (1936-1948) took place in manual-lighted boilers. These are units where fuel to the main burner can be turned on only by hand. Once lighted, though, the firing rate can be automatically controlled.

What's even more interesting, the waterwall type of boiler furnace construction is the most likely to suffer from a furnace explosion. Look at figures, facing page. Waterwall types have only relatively weak wall heads for support. Refractory furnace, though, is of much more rugged construction.

Manual-lighted boilers begin, usually, at about 10,000-lb-per-hr steaming capacity and 100 psig, and go up from there. Automatic-lighted units take in the smaller sizes.

What can you do to make sure your boiler furnace never builds up an explosive mixture? Five steps, above, give some basic precautions you can take. In addition, here are helpful operating tips.

Lighting Off. Let's establish this most important point first. A high-caliber well-trained fireman is the primary factor in safe lighting off. He instinctively goes through these steps in lighting off a boiler:

1. See that all drain valves are closed; water is in the boiler; access and observation doors are closed.

2. Check fuel valves at all burners for closure.

3. Thoroughly purge the furnace and passes for 5 minutes at ¼ maximum air-flow rate.

4. Insert a reliable lighting torch. (A dozen turns of ½-in. asbestos rope, secured by a hairpin bend, on a 5-ft length of ⅜-in.-dia steel rod is considered reliable.) Be sure torch has a substantial flame before putting it into the burner lighting part, and put it in place in such a way that main or pilot burners, if present, light off promptly.

5. Open the fuel valves at the burner, and fire the burner in keeping with the manufacturer's instructions.

6. If a main burner fails to ignite within 5 seconds after opening the fuel valve, or if the torch, pilot or main-burner flames blow out:

(a) Close the fuel valve at the main burner right away.

(b) Pull out the torch and turn off fuel to pilot, if present.

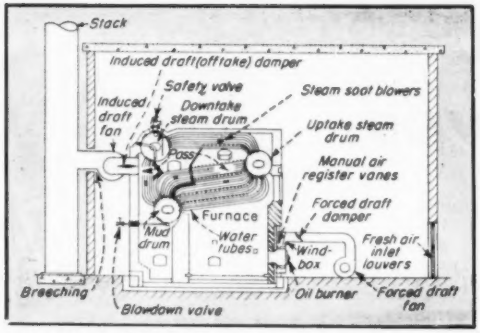
(c) Adjust dampers, burner registers and pass for no less than ¼ rated air flow through setting.

(d) Purge at this rate for 5 minutes or more before readjusting dampers, etc, and inserting the lighting torch a second time.

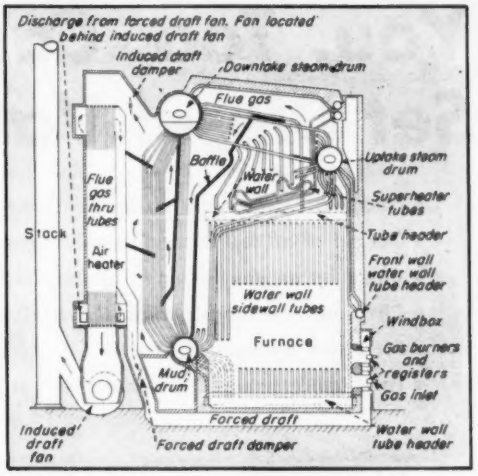
General Operation. A few operating conditions stand out in a study of gas- and oil-fired furnace explosions. Flame failures nearly always occur while firing with only one burner at low ratings —say below 30%—under low loads or while warming up shortly after lighting off. Under these conditions the boiler-furnace temperature drops off to a point below the prompt reignition temperature for the fuel.

Because of this, when boilers are fired below 30% rating, reduce the number of burners. Never try to cut back on burners once you get below the stable minimum firing rate. Instead, completely shut off individual burners so remaining ones have enough load to stay within stable operating range.

*Entire article based on Associated Factory Mutual Insurance Companies, Loss-Prevention Bulletin No. 14.25, "Preventing Fuel Explosions in Gas and Oil-Fired Manual-Lighted Boiler Furnaces."



REFRACTORY-FURNACE design, above, will give the furnace a ruggedness that is helpful in the event of any explosion



WATERWALL TYPE of furnace suffers most from any explosion because the wall supports are relatively few and far apart

How about flame failure or other combustion safeguards? Quick-acting electronic devices of the "flame-rod" type with gas, or "photoelectric" with oil, help if properly used. The flame-rod cannot sense unburned gas during lighting off, but it can see a pilot flame. While firing, both types respond to flame failure, but neither can do anything about dangerous build-ups of flammable products.

Since each and every boiler has its own characteristics that can bring on unforeseen operating troubles, let your combustion safeguards just sound an alarm to start off with. Then when you have reliable operation and you've made some necessary adjustments in firing and control equipment you can connect your combustion safeguards to shut off fuel.

As far as automatic combustion-control adjustments go there are some definite rules you ought to follow. For instance, make sure air-flow rate always follows steam flow and does not lead it. Then see that the fuel-flow rate is automatically adjusted to follow the air-flow rate. This cuts down the chance of over-rich combustion and gives safe response if fans fail.

Gas Hazards. Manual-lighted gas-fired boilers, particularly with large waterwall furnaces, have figured in some very severe explosions. The lighting-off explosion damage runs much higher than that during regular firing operation. In fact, there've been so many more lighting-off explosions with gas-firing compared to those with other fuels that previous practice has been closely checked. One thing stands out and that is a failure in the past to put in reliable pilots for each main burner. These pilots prove their worth not only in lighting off but in low-load service and warm-up periods when the boiler is bringing up steam pressure.

Chief among the hazards in gas-fired operation is leaving gas-burner cocks open too long without purging, especially during unsuccessful attempts to light off. Next comes accidentally leaving burner cocks open.

High among any list of hazards is accidental flame failure while warming up after lighting off or while firing at low ratings. Biggest reason for this is unfavorable air-gas ratio adjustments.

As more or less of a follow-up of unfavorable air-gas adjustments is the danger of not enough air for complete combustion.

Oil Hazards. Similarly there are several outstanding hazards in oil-burning operation. Most important is accidental flame-failure while warming up shortly after lighting off or firing at low rating. Its causes are many. They include unfavorable oil-air ratio, poor atomization, interruption of oil flow by oil-pressure failure or a slug of water.

Next in order of hazard importance is incomplete combustion of oil. It may result from (1) too low an atomizing pressure—either from too low a steam pressure or too large a sprayer plate (2) too low a temperature, or (3) firing at too low a rate to maintain proper furnace temperature.

Then comes the hazard created by leaving the burner oil valves open too long without purging during unsuccessful attempts to light off.

The last two, in order of importance, are (1) attempts to light burners from hot furnace refractory and (2) not enough air for complete combustion either from fan failure or failure to start draft fans or open dampers.

Recommendations. To avoid furnace explosion, there are a number of practical steps you can take in addition to the five steps already given. For gas-firing they involve: (1) providing a continuous, fixed, premixed pilot for each main burner (2) installing, where a boiler has more than one burner or burner unit, an approved cock and gas safety-control system (3) protecting against low gas pressure on single-burner boilers (4) interlocking the main safety shutoff gas valve with electrically driven draft fan (5) adding approved flame-rod combustion safeguards on 8,000-20,000 lb per hr boilers where practical.

For oil firing, these recommendations hold: (1) thermometers in the oil piping close to burners using heavy oil (2) an oil-pressure gage on the burner oil-header supplying pressure-atomizing or steam-atomizing burners (3) photoelectric combustion safeguards and interlocks with furnaces having more than two of the six walls as waterwalls or any other boiler where damage would badly cripple plant production no matter what its construction.

Further, in oil firing operate soot blowers only when the burners are firing at high ratings. Then open wide the off-take damper or induced draft to vent steam. Meanwhile throttle the air flow by means of the forced-air damper to prevent blowing out the fires.

You, Too, Can Set Diesel Valves

- *Find exact crank position as fuel injector opens*
- *Get rid of all lost motion in valve gear*
- *Check up on your engine's timing diagram*
- *Check valve settings against flywheel timing marks*
- *Set piston on top dead center*
- *Take indicator cards for final check, if possible*

1 Hook air to fuel line, remove indicator cock, listen for injector to open

By C MORGAN JONES
Marine and Stationary Diesel Engineer

► VALVE TIMING is a delicate job, but any careful diesel mechanic can do it. Fuel valves need finest adjustments. Exhaust valves need most frequent attention, followed by air-inlet valves and starting valves.

Point of fuel-valve opening in any cylinder is important. But don't believe valve markings on flywheel. These marks lose their value through wear of moving parts between crankshaft and valve stem.

Crank's Position. First job in setting valves is to find exact position of crank the moment its fuel valve commences to open.

There are several ways to do this. First, disconnect fuel line from fuel pump and connect to compressed air, Fig. 1. Remove indicator cock or relief valve. Jack engine over by hand several times to get rid of oil in injector or dirt and carbon in indicator spaces. As crankshaft turns, listen at indicator or relief valve for moment compressed air hisses into cylinder. Stop turning, and check flywheel markings for any variation.

To show when valve closes, turn engine until hissing stops. Compare position on flywheel with original marks.

Lost Motion. If both readings are within a few degrees of builder's marks, difference is from wear. In this case, check following: (1) Cams for scoring, Fig. 6, galling, grooving, chipping, pitting. (2) Bearings of camshaft and rocker arms for excessive wear, Fig. 3. Heavy camshaft bearing wear is probably from poor lubrication. Caution! Oil-pressure drop to crankshaft journals often means complete oil failure to camshaft bearings. Reason is oil pressure at camshaft is 5 to 10 psi less than at journal's. (3) Check distance between valve stem and rocker arm, cam and stem, or cam and tappets. (4) Remove valve springs and inspect for breakage, chipping, bad seating and tension. (5) Examine cam rollers for play through pin, or bore wear. If tappets, make sure threads are not worn and that locknuts hold tappet in adjusted position. A few thousandths in. lost or gained in valve mechanism affects operation. (6) Lift gear train covering and check for excessive lash between gears. If chain type, see that sprocket's tension is right and linkage OK.

After taking up on all lost motion, again turn over engine by hand. With compressed air in injector valve, again compare valve movements with builders.

Another way to test fuel valve opening is to attach a dial micrometer to a fixed part of cylinder head, Fig. 2. Have pin bear on top of valve stem, or valve spring retainer or follower. Then bar engine over with fuel valve in closed position.

Moment needle moves, it shows valve is opening. Watch needle as you bar. It tells exact distance valve opens and closes. To find approximate opening position easily, rotate roller on cam follower between thumb and forefinger while barring engine over. Roller is harder to turn the moment it makes lifting contact with cam. At this point valve should be opening, but there can be so many movement losses it's not accurate.

Fuel-Valve Timing. On all engines, fuel is injected before piston reaches top dead center (TDC), Fig. 4. It may be as little as 5 deg or more than 20 deg. This is because combustion doesn't go off with a bang when fuel is injected. This valve overlap allows combustion to get well-started before piston starts downward stroke. The higher the engine speed, the earlier injection must take place to take full advantage of combustion and expansion of gases on power stroke.

Here are some fuel-valve settings:

RPM	*BTC*, Deg*	*ATC*, Deg*
200-300	10	20
300-500	12	16
500-700	14	12
700-1000	16	10

*BTC means Before Top Dead Center; ATC means After Top Dead Center.

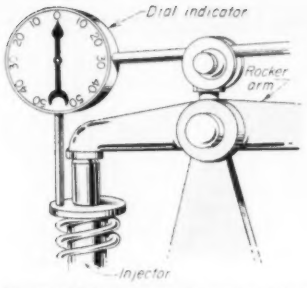
Follow manufacturer's settings.

With every injector set to deliver fuel into its cylinder at exactly same position of crank throw, take indicator cards.

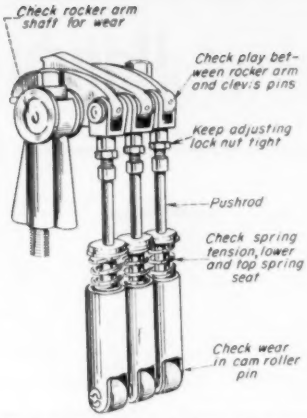
Usually, one or two injectors show a difference great enough to upset a good, well-balanced power unit. Differences can be from slightest variation in cam shape, smallest warp in camshaft, loss of valve spring tension, warping of valve stem (not noticeable when engine is cold while timing) and other hard-to-find troubles. Sometimes troubles show up only when taking exhaust pyrometer readings.

If pyrometer shows great variation, high readings usually indicate excessive fuel through high valve lift. Then low readings show valve lift is not enough. Again, adjust injectors and equalize with mean temperatures of other cylinders.

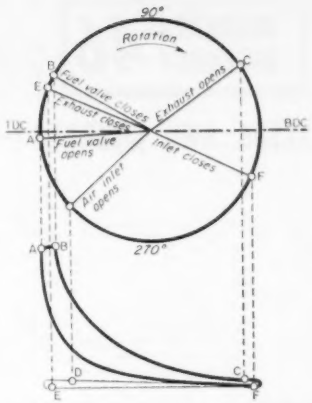
When engine receives too much fuel from advancing the timing a degree or two, corresponding pressure in cylinder increases 50 to 100 psi. Prevent this dangerous pressure on wrist pin or crosshead, also on bottom end journals. Conversely, if timing is retarded



2 Dial indicator clamped against injector shows exact injector opening point


Check rocker arm shaft for wear
Check play between rocker arm and clevis pins
Keep adjusting lock nut tight
Pushrod
Check spring tension, lower and top spring seat
Check wear in cam roller pin

3 Lost motion in all these parts can upset your engine valve timing badly



4 Here's exaggerated four-cycle valve diagram in relation to indicator card

too far, pressure is too low, resulting in smoky exhaust.

Inlet and exhaust valve diagrams show both valves are open at same time for crankshaft travel. Travel may be from 20 to 40 deg. Thus it may seem that on suction stroke piston draws in some burned gases from exhaust manifold. But no! When piston reaches top of its exhaust stroke, gases leave cylinder as high as 12,000 to 13,000 ft per minute. This speed creates a suction, so as inlet valve opens before top center, air is drawn into cylinder. By holding exhaust valve open after top center, most possible air is drawn in.

Timing Rules. Too much clearance between valve stem and its actuating mechanism means: late valve opening early closing, less valve lift and noisy running. Too little means: valve opens too early, closes too late. If excessive, valve might not close completely, causing wire-drawing.

On hydraulic valve-operated gear, keep oil pressure under 50 psi. Otherwise, plunger may lift off its seat and valve won't work.

Too little clearance on inlet valve is traced by hissing of escaping air in manifold when engine is turned over. Extremely high exhaust temperatures indicate same condition for exhaust valves.

Here are loads on valves. Exhaust valve: 45 psi on valve area, plus spring load, plus inertia of valve. Inlet valve: 5 psi on valve area, plus spring load, plus inertia of valve. So give exhaust valve most attention.

Overlap of air-inlet valve and exhaust on supercharged engine is greater—about 50 crankshaft degrees on many engines.

All valve opening and closing positions are referred to as so many degrees before or after top dead cnter, and before or after bottom dead center. Here's one way to find TDC of any piston. Place crank near TDC. Remove injector and measure from piston to cylinder head. With a tram at a fixed point, mark flywheel edge at *A*, Fig. 5.

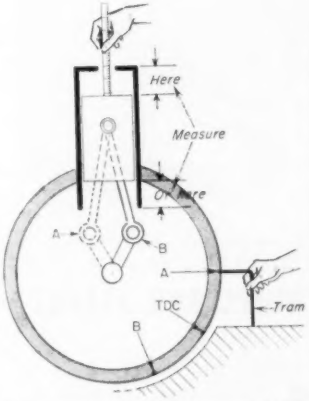
Turn engine to po-ition *B* (mea-ure from piston), mark *B* on flywheel. Divide distance between *A* and *B* on rim. Tram at this mark is TDC for piston. You can measure from piston's bottom to liner's bottom edge instead of working from top.

Timing. Sometimes an engine's timing marks are lost when taking gears out of mesh. To regain timing, place camshaft in its bearings. Before you engage gears, turn camshaft with a wrench until any set of valves (inlet and exhaust) are both in the partly open position. Turn crankshaft until valve's piston reaches TDC. Now engage gears and adjust valve clearances.

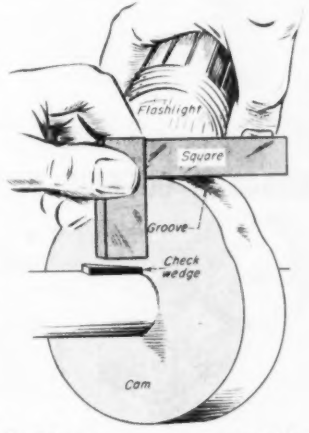
A few more hints: Make final clearance adjustments after engine is running under load and is hot (about 140 deg). If a cylinder is working "heavy" or "light" get the "feel" of it by holding a screwdriver firmly against injector body. A "heavy" injector means too much oil entering cylinder. If an inlet or exhaust roller "slams" when valve is closing, roller clearance is too great.

If there's a knock in cam after valve has closed quietly, valve stem sticks in its guide and is not seating firmly. Dose with kerosene. Touch top of injector plunger with finger. You will feel a slight jar if it's making a good contact with its seat.

Caution! Never touch timing or setting of fuel-injection valves if you have combustion troubles. First examine and remedy all other sources of faulty operation. Chances are timing is OK.



5 Set crank on TDC with trammel. Measure from piston's top or from skirt



6 Check for grooves in cams by holding light against a machinist's square

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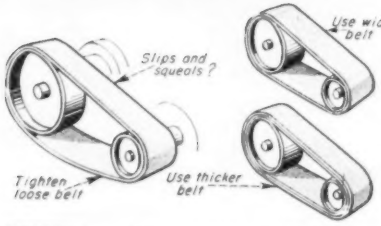
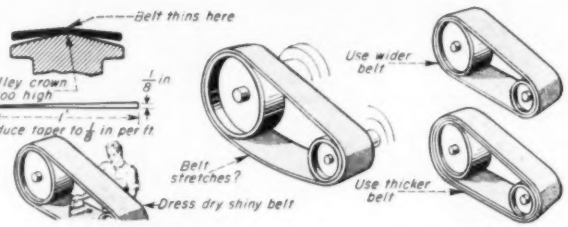
Handy Aspirin for

SLIPS AND SQUEALS?



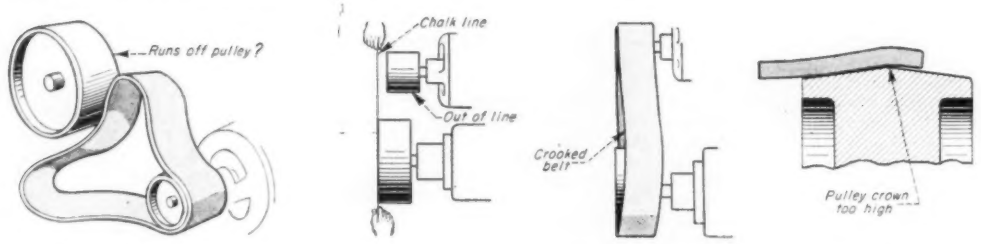
TIGHTEN loose belt, use wider or thicker belt. Keep crown taper to 1/8 in. per ft or belt thins in center and slips

STRETCHES?



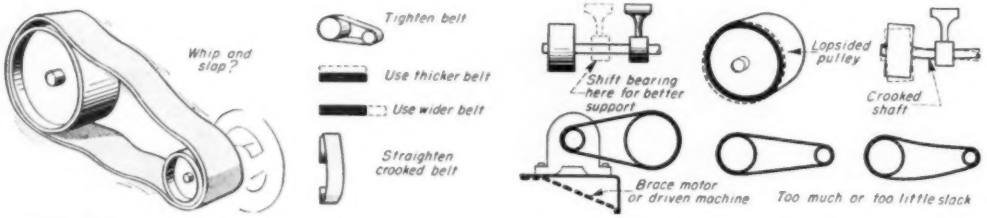
USE WIDER or thicker belt. Excessive stretch usually means that belt used is not strong enough for pulling the load

RUNS OFF PULLEY?



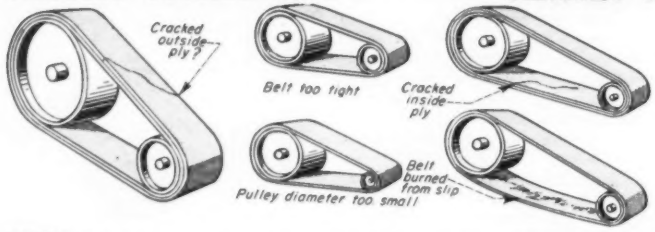
ALIGN PULLEYS with chalk line if they are out of line. Do this by holding line against rim of both pulleys as shown. On short centers, use a straightedge. Check belt's side for straightness. If straight, the pulley crown is probably high

WHIPS AND FLAPS?



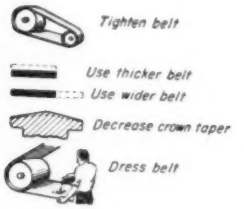
TIGHTEN BELT, use thicker or wider belt, or straighten belt. If none of these, support shaft bearing right or brace motor or driven machine. Look for lopsided pulley, crooked shaft or too much or too little slack. This is the usual trouble

CRACKED OUTSIDE PLY?



LOOSEN tight belt by moving pulleys closer together or by splicing belt. Or use larger pulley to increase radius

CRACKED INSIDE PLY?

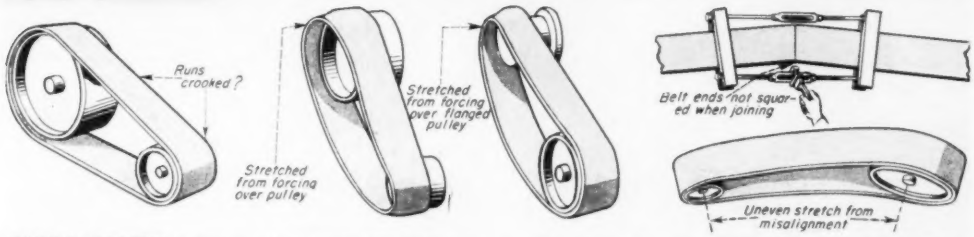


TIGHTEN belt, use thicker or wider belt, decrease crown taper or dress belt. One of these will stop inside ply cracks

Leather Belt Headaches

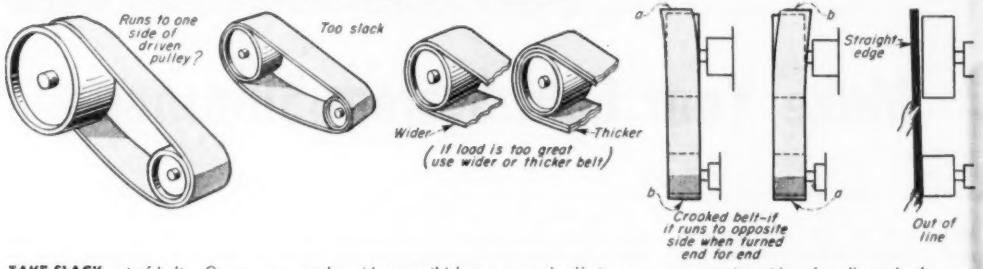
By **STEVE ELONKA**, *Associate Editor*

RUNS CROOKED?


Runs crooked?
Stretched from forcing over pulley
Stretched from forcing over flanged pulley
Belt ends not squared when joining
Uneven stretch from misalignment

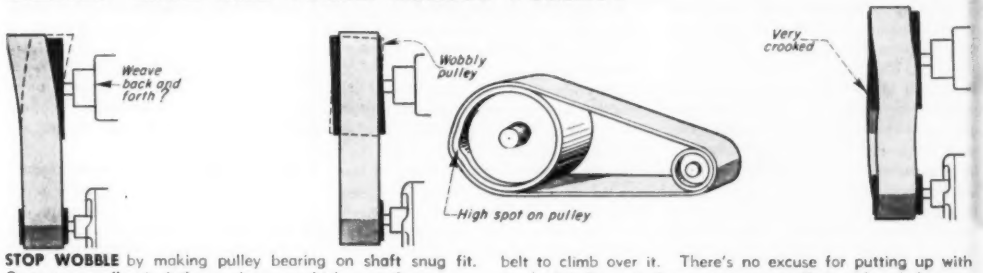
CROOKED RUNNING is hard on belts. Never force belts over pulley or over high pulley crown. That stretches it badly on one side. Take up evenly on both sides of clamp when joining the ends. Align the pulleys and then keep them so

RUNS TO ONE SIDE OF DRIVEN PULLEY?


Runs to one side of driven pulley?
Too slack
Wider
Thicker
If load is too great (use wider or thicker belt)
a
b
Straight edge
Crooked belt—if it runs to opposite side when turned end for end
Out of line

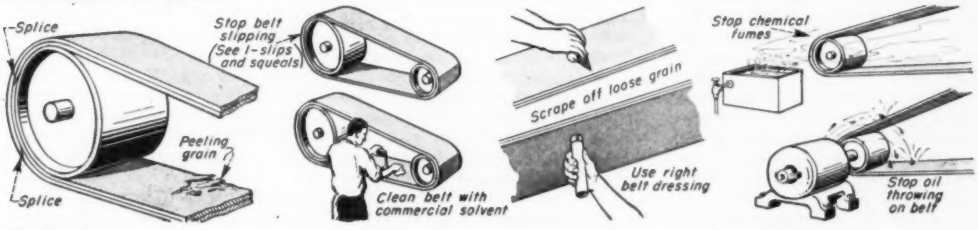
TAKE SLACK out of belt. Or you may need a wider or a thicker belt. Quick way to check if belt is crooked is to turn it around. If it runs on opposite side of pulley, that's your trouble. And here again, check the pulleys for alignment

WEAVES BACK AND FORTH ACROSS PULLEY?



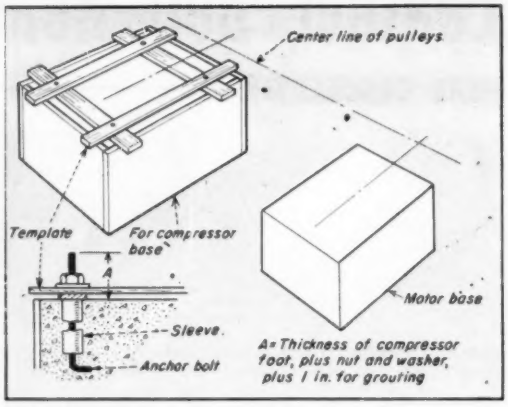
STOP WOBBLE by making pulley bearing on shaft snug fit. Or true up pulley in lathe, and remove high spot that causes belt to climb over it. There's no excuse for putting up with crooked belts, yet they cause weave that makes belt wear

PEELING GRAIN?



PREVENT belt slipping and squealing, clean belt with a commercial solvent, stop chemical fumes, scrape off loose grain, use right belt dressing and keep oil off belt. For more info., write American Leather Belting Assn, 41 Park Row, N. Y. 7

HAULING and unloading can damage machinery. Inspect parts soon as delivered and make necessary claims at once



ANCHOR BOLTS spaced with wooden template on top of form before pouring concrete. Sleeve helps the anchor bolts "float" a little

Make Your Cold System Shipshape

By **TERRY MITCHELL**, *Frick Company*

EDITOR'S NOTE: *Here are two pages packed full of practical installation tips from the notebook of an authority in his field. In a future article, Mr Mitchell will go into bearings, belting, machinery, dryers and other items to be installed. This information, gathered from years of installation experience, can save you many headaches.*

► CHIEF ENGINEERS can install new refrigeration machinery if it's carefully planned in advance. First, cooperate with sales-engineer who lays out refrigeration system. Then check drawings and specifications. Dont' forget that equipment will be furnished and set up exactly as shown on the blueprints. So if you want changes—ask for them *now*.

What to Plan. While factory's filling the order, arrange for items that must be supplied locally. These include: electric power lines, water and drain connections, tools, openings through walls, insulation, painting, working facilities, hauling, rigging, foundations and permits.

If the job is big, get a stout workbench with a pipe vise. Also, a welding outfit or a small forge. Arrange with hauling and rigging contractors to unload cars promptly, to avoid demurrage charges.

Well before refrigerating machinery must carry a heavy load, plan to operate it. Don't expect to finish installation on a Friday and have tons of warm produce arrive the next Monday. Why? A pump bearing may run hot, or a control valve stick. Then whole plant will shut down while fresh foods spoil.

Machinery passing every test at factory may shake out of adjustment in shipment, or pull out of alignment on job. Railroad cars "humped" in yards often have their contents damaged; truckers often drop boxes of sensitive apparatus.

Remember that railroad, truck line or other carrier must be held responsible if equipment is damaged or lost in shipment. Check pieces carefully with drawings, packing lists and bill of lading. Examine everything before and after being unloaded. If necessary, enter a claim with the agent promptly—after ten days you may lose right to damages.

Manufacturer can furnish an erecting engineer and pipe fitters to make installation and run test. If they do this, have a man work with them so he can operate equipment alone.

Study maker's bulletins, contract papers and instruction manuals until you almost know them by heart. Visit similar jobs elsewhere, talk to engineers who handle machinery, and learn headaches to avoid. Become familiar with controls, especially, and how to adjust them.

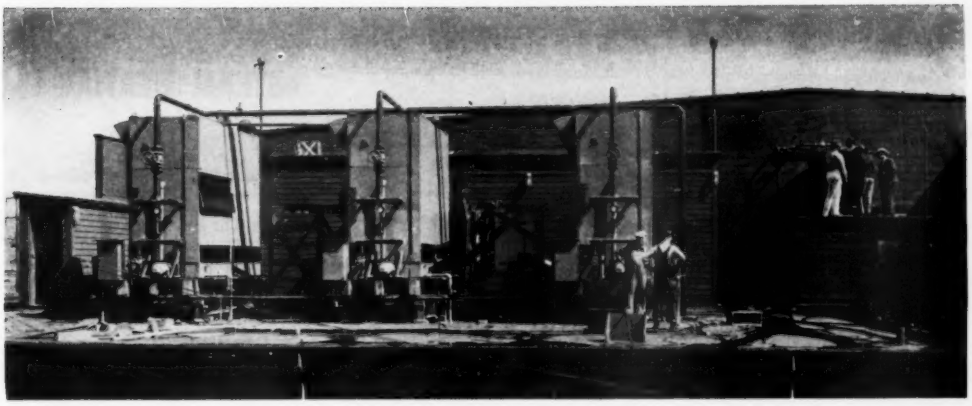
Stock up on right oil for compressor, and spare parts and supplies you may need. Builder usually furnishes first oil change with machine. But it becomes dirty in a few days and must be replaced with fresh. Make certain you have all pipe fittings required. Have on hand valve-stem packing, valve plates and springs, gaskets, refrigerant, litharge and glycerin, paint, thermometers and mechanic's tools.

Don't install refrigerating machinery in a dark, damp basement, where it will become rusty. Place in a dry, clean, well-lighted place. Allow enough space around equipment to get at each piece safely. Have good ventilation if motors, belts, control devices, and piping are to last.

Locate compressor where pistons and crankshaft can be removed; makers tell what headroom and space are required. Tubes in shell condensers and coolers may also need replacing. A consultant who laid out a great engineering laboratory once admitted his only serious mistake was placing a condenser so tubes couldn't be withdrawn without knocking down a wall.

Plan for additional machinery space if plant grows. Install floor drains. Where frost and ice must be washed from coolers or freezers, have drain pipes four or five inches in diameter.

Foundation. Drawings show how to build foundations for average conditions. Footings may have to be enlarged if you run into soft or marshy ground. Hard-pan clay is almost as safe as solid rock; either calls for minimum-size foundations. If you can't have vibra-



SUPERVISE pipe fitters closely during this stage of the work. Even the most careful workmen get foreign matter in the lines that fouls up your new system after placing it in operation. A close watch now will pay off in long, troublefree service

CHECK THESE POINTS

1 Power lines
2 Water supply
3 Drain outlets
4 Blueprints—literature
5 Tools needed
6 Insulation
7 Hauling facilities
8 Rigging work needed
9 Foundation conditions
10 Permits required
11 Damages and claims
12 Supplies for operation
13 Piping and fittings

tion and "telegraphing" of sound to other parts of building, install isolation corkboard in concrete. That calls for special drawings common in air-conditioning work.

Concrete for foundations is one part portland cement to three parts sand and five parts crushed stone, all measured by volume. Use clean sand and stone, free from soil or loam. Even a little dirt destroys strength of mixture. Hard, screened stone is best. Allow two full days and nights for concrete to harden before removing forms or putting compressor in place.

When installing small equipment, level forms carefully and make concrete even with top of boards, which are planed smooth. Then bolt machine to flat surface, without using any grout. With large compressors, allow an inch of space for inserting wedges and grouting.

Making Foundation. Secure a wooden template for locating the anchor bolts. Brace the form in all directions, so it cannot shift; square the template with the foundation, and line it up with the base of the driving motor or engine. Then nail the template to the form.

Next thread the anchor bolts through the holes in the template, each bolt being surrounded by a ferrule of old pipe or tin spouting. The ferrules are made three or four times as large on inside as the bolts. This permits moving the machine when being finally aligned. At the top of each ferrule, insert a plug or spacer to keep the bolt in the center.

See that the anchor bolts extend above the form's top enough to equal casting's thickness, plus the thickness of nut and washer, plus the inch allowed for grouting. See sketch.

Wedges are usually cast iron, but wooden ones will do. They should be about six inches long, two inches wide, and one inch thick, with a smooth taper to a thin edge. Place two wedges on each side of machine and one at each end, close to the anchor bolts. Drive wedges in slowly, as they're easier to insert than remove. Set machine square, level in both directions. Also at right height, and in line with its outboard bearing, if bearings separate. Place a spirit level on shaft and check other direction at planed surface of water jacket or cylinder head.

For filling holes around anchor bolts, use a thin grout made with equal parts of clean sand and cement. Around machine base, use a slightly thicker grout, which tends to float but does not show water floating on top. Ram this in well and remove excess air trapped under casting, if possible. After about 50 hours, remove the wedges. Some erectors prefer to leave them in place, buried in cement. Draw foundation bolts tight after the grout is thoroughly dry and hard.

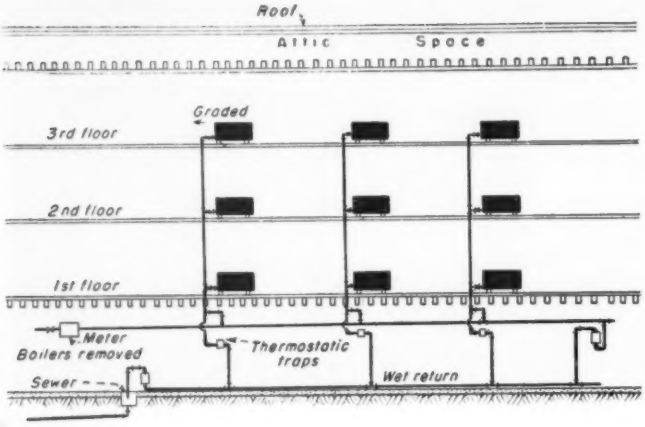
While foundation cement is hardening, make pipe connections between other parts of system. Check valves and fittings against drawings carefully.

Piping. Threads on pipe must be a full-length taper of standard size so shoulder does not strike at end but tightens gradually. Clean threads with steel wool until bright, if rusted. Use Stoddard's solution if greasy, then wipe dry.

Stand pipes on end and rap lightly with a hammer to remove scale and dirt. Coat threads on both pipe and fitting with a smooth paste of litharge and glycerin. You can buy those chemicals at most drug stores, or from pipe and mill supply houses. Mix them until creamy, preparing only enough for immediate use, as the paste soon gets hard. Avoid mistake of pipe fitter who applied so much litharge to threads of a ½-inch liquid line that it clogged openings and had to be dismantled.

Solder is seldom used in ammonia work. Litharge holds just as well and is easier to apply.

Follow these suggestions and chances are your plant will do work it was designed for. I've found that more needless headaches develop in a new plant from overlooking little details during the installation period than from any other cause. So watch details *now*.



STEAM HEATING

Valves, traps, vents plus piping make or break steam heating

Check your piping supports, pitch

Adjust vents to balance system

See that the traps are working

Be sure all valves open fully, close completely

Run a check on your steam pressure at the traps, if you can

Get Your Heating System in Order

There's still time to give your heating system a good going-over. Here are some helpful checks you can run even under a light load

► RIGHT ABOUT NOW your heating system is coming into service. The full load is a month or more away so there's still time to get ready. In fact, with a light load on your system you can give it a "trial run" without making anybody uncomfortable.

A few months back (POWER, June 1951 pp 124-125; *Operating Engineer*, Nov 1950, pp 32-33) we ran tips on heating boilers. So for now we'll stick to the job of the heat-distribution system—pipes, traps—and the bigger heat-transfer equipment like unit heaters.

But before we get under way just take a quick run around the plant. How many new areas have been made by shifting or adding partitions throughout the plant? Have there been any inventory or stock pile-ups, temporary or not, near heat-transfer equipment or in the path of unit-heater discharges? It is a smart idea to get these changes down on paper. Make them a part of your heating-system survey, and you can point out the effect they have on heating results. What's more, you can indicate the steps to take to best fit your system to the changes.

Piping Check. Next, you should run a check on how you distribute heat throughout your building. If you're using steam or hot water, diagrams above, you've got a good-sized installation of piping and fittings that need maintenance. No heating engineer ever has to be told that piping makes or breaks his heating system. There are cases on record where new radiators or convectors have been cut into a heating system during off-months and no attempt made to balance the system. Even worse, cross connections are sometimes put in between main steam header and returns on 2-pipe systems that let the steam bypass whole areas.

This piping check gives you the chance to work up an up-to-date piping diagram of your heating system if you haven't already got one. With it you can set up an intelligent spare parts inventory as well as shoot trouble.

While you're about it, study your piping system supports. See if you have enough of them and if they are still holding the pipe where you want it. Proper piping pitch is highly important, you know. Any water build-up in a sagging section of pipe can cause you trouble. If flow through that pipe has any appreciable velocity, "water hammer" might develop. And under extreme conditions water hammer can rupture pipe or fittings.

How about pipeline expansion? Many low-pressure heating systems rely on certain fittings turning on their threads to take up pipeline expansion. As time goes by these threads can suffer from corrosion and prevent any movement. Only positive way to build freedom from expansion troubles into your system is to put a few runs of curved pipe, expansion loops or, for larger systems, some one of available expansion joints.

Valves and Traps. The role valves, traps and vents play in any steam or hot-water system can't be emphasized enough. The simple one-pipe system, above, depends on air valves or vents on individual radiators to keep heat flowing through the radiators.

Float and thermostatic traps, instead of vent valves, followed up by air eliminators, permit a steam system to operate at lower pressure—a vapor system—with faster heat-up to give some operating economies. But just how much this system saves depends on how well the traps work.

You can carry this same idea through to systems using a return trap. In all of them smooth working traps are fundamental. What are some simple maintenance checks you can run?

In service a slight temperature difference between inlet and outlet indicates a working thermostatic or thermodynamic trap, provided, of course, inlet

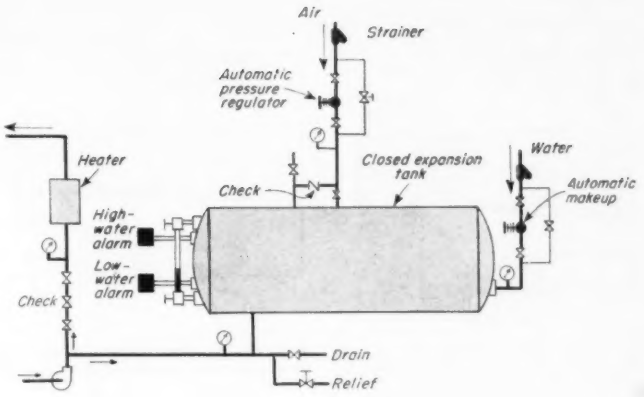
HOT-WATER SYSTEM

Expansion tanks play a big part in a smooth-working hot-water heating plant

Go over all system controls

Check the alarms for high and low water

Be sure any automatic makeup or pressure regulators are set to operate at levels you want



temperature is up to normal. No difference in temperature means a leaking trap; a big difference or a cold trap indicates no condensate is passing. Intermittent-discharge traps produce a light clicking sound each time they operate. Constant-di-scharge traps can be checked with a listening rod or a stethoscope applied to the trap body. Bellows, diaphragms or thermal strips for low-pressure systems may be checked for operation in a bath of hot water.

You might check the pressure on the heating units. If it runs too high, it may damage thermostatic traps or make it impossible for a mechanical trap to open against it. If the pressure runs too low then there's not enough steam getting to the trap and its capacity is not enough at this different-from-rated differential pressure.

Any trap that discharges to a vacuum requires that all parts be tight against air leakage. If a bucket trap fails to discharge, it might not be getting any condensate. The line may be clogged or dirty, or perhaps differential pressure across the trap is too high.

A continuously discharging bucket is probably too small or else it's clogged with dirt. It could be, though, that backpressure has built up to where differential pressure results in below-capacity performance.

Expansion Tanks. If you run a hot-water heating system, look after your expansion tank, above. It has a lot to do with good system performance. It usually supplies makeup water for that lost by evaporation and gland leaks. What's more, it keeps the pump from becoming vapor-bound since it maintains a positive head on the pump suction. Further it serves, as its name implies, as a place where expanded water can work itself off without building up any dangerous pressures in the system.

If you put a simple water meter in your circuit, you can keep check on any system leaks. When the entire system is above ground and exposed, any leak is easy to find. But if you have some concrete-imbedded or underground lines, a leak may not show up as readily. A water meter, though, will set you to ferreting out any leaks if it shows a heavier consumption than normal.

Ductwork. Hot-air heating systems using ducts require as much housekeeping as they do maintenance. For instance, lint and dust accumulate on outlet registers and in ductwork itself. These accumulations upset normal air movement. Ductwork hung from low ceilings is often vulnerable to dents and bangs. Any break in the smooth duct surface sets up possible air-turbulence and noise-making sources. Wherever sections of duct connect into others, a close check is in order on how air-tight the joint is.

Insulation. The value of insulation on heating systems has been proved time and again. For steam and hot water heating it means both money-savings and quicker heat pickup for the system. Starting up from scratch on a cold morning and feeding steam into a lot of bare pipe places a heavy, long-drawn-out load on your boiler before you begin to get results.

With ductwork a lot depends on the areas through which the ducts travel. Heated air in the ductwork has not the temperature difference between it and the surroundings that steam and hot-water pipes have. If, however, the duct runs through some cold sections, insulation is an operating aid.

Unit Heaters. As far as the actual heat-trans-fer equipment goes—radiators, convectors, hot-air registers—you need only check to see if they have been broken or damaged. Unit heaters, though, can stand a rather detailed going over.

Motor inspection ranks high among the first things to do. Remove all dirt and grease from motor housings. As a general practice dismantle motors every third year and give them a thorough cleaning inside and out.

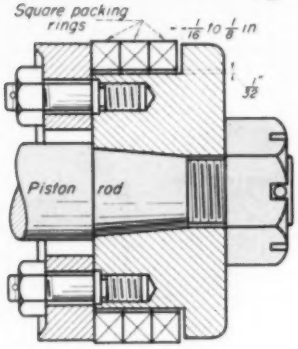
Follow manufacturer's lubricating instructions carefully. You'll usually find them on tags attached to the unit-heater motors. As a general rule unit-heater motors need lubricating about every 2000 hr. Just how you lubricate depends on the type of motor. But whatever you do don't overlubricate. More motors are lost that way than from underlubrication.

The unit heater condenser suffers pretty badly from lint and dust build-up over the summer months. You can usually clear them out without taking it down. Loosen the dirt with a brush on the fin side where dirt enters the condenser. Then just turn on the heater fan and blow it out. Still another way is to run a high-pressure air hose up to the heater and direct it at the fins from the side where the air leaves the condenser.

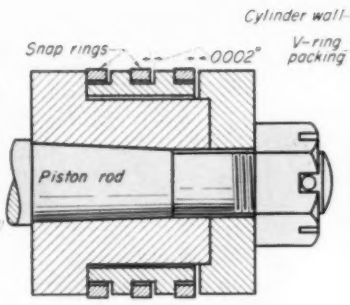
If you find any rusted or corroded spots on the unit heater casing when you're cleaning it off, touch them up so they won't grow.

Look over fan guards and motor brackets. Tighten them where needed. See that the fan has plenty of clearance, is free to rotate, and has a firm connection to the motor drive shaft.

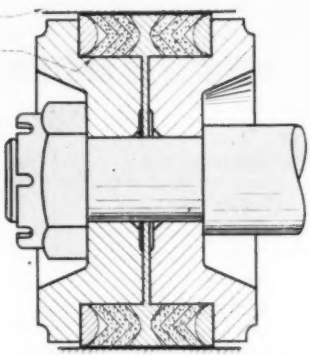
A heating system survey like the above from boiler to heat-transfer equipment will give the best possible results from your system.



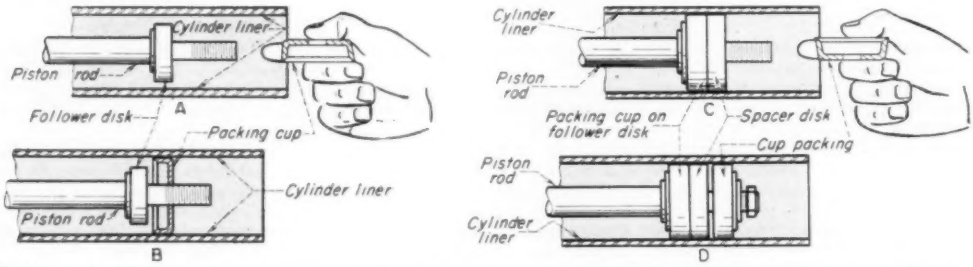
1 Properly fitted hydraulic packing can swell and not be too tight in cylinder



2 Metallic packing rings are used to pump viscous liquids like crude oil



3 V-ring packing is made of leather, rubber or synthetic-rubber compounds



6 How to install cup packing on pistons. *A:* Put in first packing cup until its lip is in liner. *B:* Turn the cup to vertical with lip facing follower. *C:* Slip spacer disk over piston rod. *D:* Put in second cup; lip faces outside cylinder

Pack Pump Pistons Right

To make this job easy for you, the Hydraulic Institute has developed standards that cover four types of packings. Here are eleven rules on how to install cup packings on pistons

► A PUMP IS NO BETTER than its packing, so be careful how you select and apply this material. To help you get the best kind for your pumps and, therefore, the best service from them, the Hydraulic Institute has developed standard instructions for reciprocating-pump-piston packing.

The pistons may be packed with: (1) square hydraulic packing (2) metal or synthetic rings (3) leather or synthetic-rubber V-rings (4) leather or synthetic-rubber cups. These materials are shown in the order named in Fig. 1 to 4.

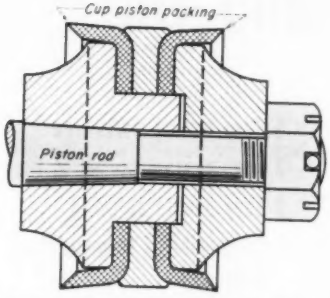
Hydraulic Packing. There are two types of canvas hydraulic packing: (1) regular cure, which can be had in coils or molded rings and (2) rock-hard, in molded rings only. Regular-cure packing is used on pistons of pumps handling water up to 180 F. For water above 180 F and up to 250 F use rock-hard-cure packing. For oil or gasoline at a temperature of not more than 212 F. and for mineral seal oil, rock-hard-cure packing is recommended.

Packing Installation. Joints in packing may be straight cut, Fig. 5*A*; angle cut, Fig. 5*B*; or step cut, Fig. 5*C*. Pressure applied to rings of canvas hydraulic packing should be relatively light so the packing retains its elasticity.

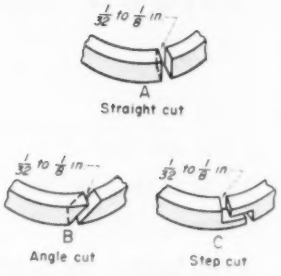
Have packing fit piston as in Fig. 1. Allow 1/16-in. side clearance for packing up to 3-in. width. When the packing width on the piston is more than 3 in., make side clearance ⅛ in. When the packing rings fit snugly against the cylinder wall, they should have 1/32-in. clearance between their ends if they are up to 3 in. in diameter; 1/16 in. for rings from 3 to 7½ in. in diameter, and ⅛-in. clearance for rings over 7½ in. in diameter. Rings with this clearance between their ends will clear the piston radially by about 1/32 in. as in Fig. 1.

If liquid pistons have hydraulic or fibrous packing, it may swell and cause stiff operation. This is particularly so with direct-acting steam pumps. Too tight packing causes cylinder liners to wear rapidly. To prevent, carefully fit packing to the liner.

Piston-Ring Packing. In general, metallic bull rings and piston rings, Fig. 2, are used for pumping viscous



4 Cup packing can be made of leather, rubber or synthetic-rubber compounds



5 Ring joints. *A*: Straight-cut joint. *B*: Angle-cut joint. *C*: Step-cut joint

fluids like crude oil, tar, molasses. They are also used for chemical service where other packings are not suitable. Materials for bull and piston ring packings may be cast iron, bronze, bakelite or monel. Cast-iron rings are good for temperatures up to 750 F; bronze 450 F; bakelite (asbestos base) 350 F; monel 750 F. Monel is sometimes used to prevent corrosion and contamination. Nickel-alloy cast iron is also recommended where corrosion is a factor.

Ring Joints. Metal rings may be had with three types of joints: straight cut, angle cut and step cut, the same as for hydraulic packing. Usually a straight-cut joint is the one used. But an angle- or step-cut joint may be selected for the application.

Ring Clearance. Metallic packing rings for pump pistons are made with an end clearance of 0.003 in. per in. diameter. For an angle-cut joint, end clearance is slightly less than for a step- or straight-cut joint, to keep ring radial clearance on piston the same for all types of joints. Straight-cut joints are preferred especially on narrow rings because they are stronger and easier to fit.

Bakelite rings are used for oil, salt water, creosote, chemicals and hot fluids except solutions that have chemical concentration like soda, ammonia, hydrochloride acid and caustic in excess of 5%, and brine or sulfuric acid in excess of 10%.

Canvas-base bakelite rings are good for 250 F, and asbestos bakelite for 350 F. Graphitized asbestos-base bakelite rings good for up to 350 F are used where standard materials do not have enough lubricant.

Ring Forms. Bakelite rings are made in either one piece with built-in tension, Fig. 2, or in segments with an expander to provide the necessary ring tension.

A square cross section is preferred for bakelite rings, but for existing designs, piston groove dimensions determine ring cross section. Sometimes one-piece rings are used on solid pistons and sprung on. For such uses do not have the ring thickness more than 1/16 in. per in. of piston diameter.

If all rings are installed in the same space, allow an end float of 0.007 in. per in. of piston diameter. Do not have the rings fit snugly around the piston's body. Float in the rings allows for swelling and uniform alignment against the cylinder-liner wall.

Leather Piston Packing. Leather V-ring packing may be used where temperature is not above 180 F. Do not use leather packing for steam at any pressure or in contact with strong alkali solutions, caustic or weak acids. For high pressure, use firm leather packing, pliable enough to seal at the lowest operating pressures.

Number of Packing Rings. In general the number of V-rings per packing set on each side of center piece, Fig. 3, are: from 0 to 500 psi, 3 rings; 500 to 3000 psi, 4 rings; 3000 to 10,000 psi, 5 rings; and for pressures over 10,000 psi use 6 rings.

When replacing V-packing inspect all parts in contact with it for wear, nicks, scratches, scores and pitting. If these surfaces are not smooth, packing will wear fast and may not seal properly. Fig. 3 shows V-packing properly installed. When installing the packing give it a coat of oil or grease.

Synthetic Rubber. V-ring packing can also be molded of synthetic rubber and rubber compounds. It can be held to close dimensions and will work in strong acid and alkali solutions. In general, this packing can be used in the same services as leather, but can operate at temperatures up to 250 F or higher, compared to 180 F for leather. The rules that apply to the installation of leather packing also hold for synthetic.

Leather-Cup Packing. The same limits that apply to leather V-ring packing hold for leather-cup packing. Also, installation rules will be the same as for composition-cup packing.

Composition-Cup Packing. Molded composition cups are usually made of laminated duck and synthetic, oil-proof rubber, molded to shape, Fig. 4. Most packing manufacturers recommend a single grade of cup material for most applications. Generally, these uses fall in a range below 250 to 300 F and 1000 psi. If you change packing manufacturers, consult the new one on the quality to use.

Installing Cup Packing. When installing cup packing on pistons follow these recommendations:

1. Be sure there is enough clearance between the inner wall of the cup and the outside diameter of the follower plate.

2. See that the cylinder liner is smooth and not worn. Replace a scored or badly worn liner before installing new packing.

3. Clean cylinder liner and cups with a cloth free of lint and grit.

4. Lubricate outside diameter of packing cups.

5. Push the piston rod into the cylinder liner to permit assembling the piston in the cylinder.

6. Place a follower disk on the piston rod tight against the shoulder, Fig. 6*A*.

7. After the follower disk is in place again, clean the cylinder liner.

8. Put in the first packing cup, holding it horizontal, Fig. 6*A*, until the lip has entered the liner. If packing is too hard, soak it in warm water.

9. When edge of packing is in the liner, turn the cup to a vertical position with the lip facing the follower disk, Fig. 6*B*. Lightly tap the cup into position, snug against the follower disk.

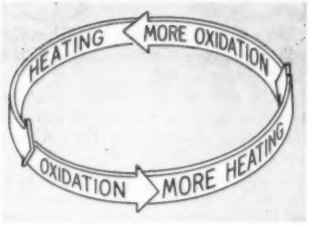
10. Slip the spacer disk over the piston rod, tight against the first cup, Fig. 6*C*. Put in the second cup, Fig. 6*C*, and when its lip clears the end of the liner, turn the cup to the vertical with its lip facing the working end of the cylinder. Fig. 6*D*.

11. Place the follower disk on the piston rod, tight against and inside the second cup, Fig. 6*D*. Tighten piston-rod nut to grip the cup flanges firmly between the followers and spacer. Do not tighten the piston nut until the cups are distorted. When follower plate is reasonably tight the cup will fit the cylinder closely and not be distorted.

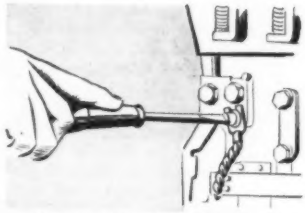
10 Ways to Check Ac and Dc Controls . . .

1 Keep unit tight
2 Keep unit clean
3 Keep contacts unpitted
4 Keep unit dry
5 Keep contacts free of copper oxide
6 Keep moving parts free
7 Keep contact pressures firm
8 Keep shunts unfrayed
9 Keep ambient temperatures matched
10 Keep within rated voltage

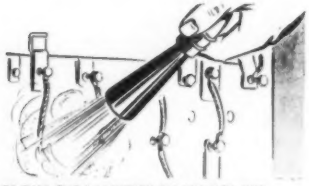
By C B OLSEN
Maintenance Supervisor
Westinghouse Electric Corp



LOOSE CONNECTIONS CAUSE HEAT . . .



. . . SO TEST THEM PERIODICALLY



BLOW CLEAN WITH 30-50 PSI AIR

USE OIL *ONLY* ON MAGNET SURFACE

1. Make Sure All Connections Are Tight

Loose connections can cause trouble on any type of control. Loose contacts offer additional resistance to current and develop heat which in turn causes oxidation. Since copper oxide is not a good electrical conductor, it further increases resistance and heating. If not checked, this process becomes a vicious cycle that may cause complete failure or burnout of the part involved.

Failure to keep connections tight may lead to faulty sequence operation of a controller, causing unnecessary shutdown. Connections to heater elements of thermal overload relays are particularly vulnerable since loose connections at this point can result in additional heating. This affects the calibration of the relay and may even destroy it.

Tightness is doubly important for rheostats and resistors. Increased resistance of connections may result in control failure, loss of field, and resulting overspeed in dc motors, and loss of field in synchronous motors. Unbalance or open circuits in secondaries of wound-rotor motors are often the result of loose connections to the resistors.

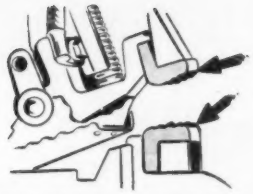
Check connections periodically since vibration, temperature or carelessness can cause them to loosen again. Lock nuts, lock washers, etc, help prevent this.

2. Make Sure All Operating Parts Are Clean

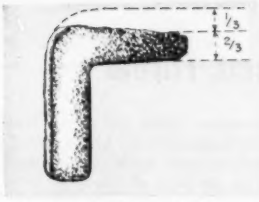
When dirt accumulates on control equipment, the best way to remove it is blowing clean dry air at from 30- to 50-psi pressure. If this doesn't remove it all, complete the job by wiping with rags or washing with suitable cleaning fluid.

In general, no oil or lubricant should be used on the component parts of control equipment. Lubricants cause dirt to adhere and result in a sticky, gummy mess that causes sluggish action of the moving control parts.

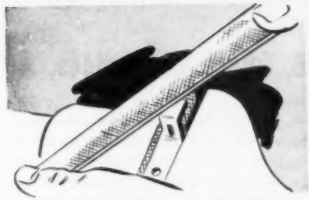
There are, however, some exceptions to the "no lubrication" rule. Magnet sealing surfaces should be wiped occasionally with an oil-moistened rag to prevent rust and resulting noise. Use a mineral oil and a clean wiping rag.



ARCING CAUSES EXCESSIVE PITTING



REPLACE WHEN OVER 1/3 WORN



IF LESS THAN 1/3, FILE SMOOTH

3. Inspect All Electrical Contacts for Excessive Roughness

A moderately rough contact surface is just as good and possibly even better than a perfectly smooth one. Surfaces no rougher than coarse sandpaper require no attention.

Unusual arcing may cause rough spots or pits on certain contacts. In that case you can do one of two things:

1. If the contact hasn't worn down more than 1/3 of its original thickness and isn't too badly pitted, it can be dressed smooth with a fine file and sandpaper; hold filing to minimum.

2. If the contact is less than 2/3 of its original thickness or if it is badly pitted or no longer compresses the spring, replace it with a new one. Contacts should be replaced in pairs or sets to maintain uniform contact pressure over the entire area. This insures good operation.

Continuous excessive burning and pitting of contacts is a pretty good indication of overloading, loose contacts or lack of maintenance on starter's blowout coils and arc boxes.

4. Make Sure Device Is Kept Dry

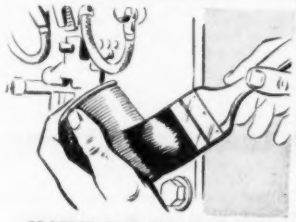
Moisture is the principal enemy of electrical insulation. It may result from: (1) condensation due to temperature changes (2) extremely humid atmospheres (3) overhead drip and spray. Moisture can cause grounds which in turn may result in unexpected operation. They can cause false starts, prevent normal stopping, eliminate overload protection or interfere with the normal sequence of operations.

Some times it may be necessary to install heaters in the control housing, which may be energized when the control is idle. In normal operation, the heat generated in the resistors and coils does an adequate drying job.

In damp or corrosive atmosphere, treat coils periodically with the proper insulating varnish. First make sure the equipment has thoroughly dried. Either circulate heated dry air or use infrared lamps. Keep close watch on the temperature and do not let it exceed 90 C (194 F). If temperature rises to 100 C (212 F) or more, moisture trapped in pockets may turn to steam under pressure and cause further damage to the insulation.

Paint exposed metal surfaces regularly when controller is located in a humid or corrosive atmosphere. Select the paint for its corrosion-resisting qualities.

BLOW IN HEATED DRY AIR



PROTECT COIL WITH VARNISH

5. Look for Presence of Copper Oxide

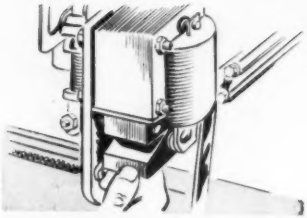
Equipment that remains in either the energized or de-energized position for long periods of time may develop an oxide film on the contact faces resulting in increased resistance and heating. This condition may also occur at bolted surfaces. When trouble of this nature occurs, clean the surfaces with a fine file or sandpaper, never use emery cloth. Oxide film on contact surfaces can be avoided by occasionally wiping with a cloth moistened with vaseline.

In more modern equipment, silver inserts on the contacts and silver-plated bus-bar connections are often used. Oxides and sulfides of silver have little effect on resistance, but copper oxide is poor conductor, causes heating. (*Turn page*)

WIPE CONTACTS TO AVOID OXIDE

6. Check Clearances, Alignment, Friction

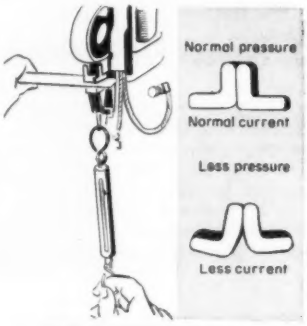
At regular intervals, operate by hand the contactors, relays and circuit breakers to note if any undue friction or binding occurs. Also check the alignment of contacts on multi-contact devices to see that the contacts make and break simultaneously. This will help prevent excessive burning on surfaces of individual contacts.



OPERATE MOVING PARTS BY HAND

7. Test Firmness of Contact Pressure

A small contact with suitable pressure will carry more current than a large one with little or no pressure. Make sure all contact springs are in good condition. If one has been damaged or has lost its temper because of high temperature from arcing, it should be replaced. Contact pressures should be maintained along the manufacturer's recommendations. Check pressure with a small spring scale attached to the contact tip. Check also for insulation under springs so it doesn't become a parallel path. Contact pressure is scale reading when contacts part.



CHECK PRESSURE WITH SCALE

8. Check for Frayed Shunts

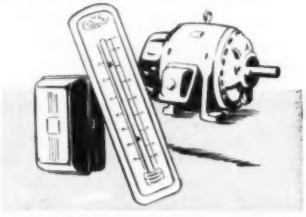
Shunts are generally flexible bands of woven copper strands that carry current from moving contacts to stationary studs. If frayed they can cause grounds.

If a shunt is unduly bent, some of its strands may break, causing additional loading of remaining strands. Replace shunt with a new one as soon as this condition is noted. In extremely corrosive atmospheres, shunts have been known to fall apart before any warning sign of failure was apparent. Check if wire is tight in lug.

REPLACE ALL FRAYED SHUNTS

9. Check Ambient Temperatures of Relays

Thermal relays are calibrated to operate at one definite temperature and in general should be in an area that has the same temperature that prevails at the motor location. Adjacent steam pipes or processes resulting in higher ambient temperatures will result in premature operation. In conditions of this type, give special attention to selection of heater elements. High ambients trip heaters below rating.



KEEP RELAY AT MOTOR AMBIENT

10. Make Sure Device Operates at Correct Rated Voltage

Overvoltage can shorten coil life and cause excessive wear in contractors and relays. A voltmeter check tells story.

Low voltage can cause sluggish action. This means that contact tips may touch but not be forced together against spring pressure. Under this condition, heating results and contacts may weld together. Undervoltage may also result in complete failure of a controller due to improper sequence.

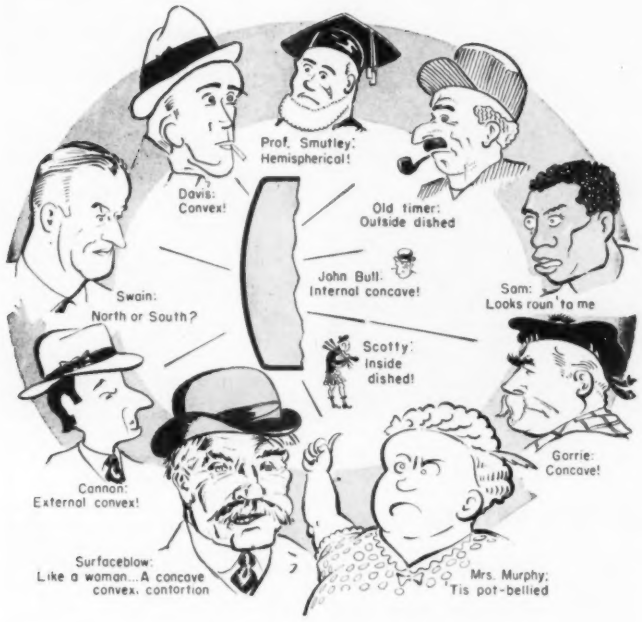
* * *

This article is adapted from a lecture delivered by the author before the Hillside Maintenance School.

ARGUMENTS

Here's the place to unload your gripes to editors, manufacturers and fellow engineers

—STEVE ELONKA, *Associate Editor*



POWER ENGINEERS COULDN'T AGREE . . .

I GOT QUITE A KICK out of seeing Gorrie all dressed up inside that concave-convex headed tank (see "Arguments," Aug POWER). The argument reminds me of the examiner who asked the question: "Are manhole covers elliptical or round?" The applicant replied, "I wouldn't know, what few I've seen were oval."

But before we get conniptions over the controversial conundrum—convex vs concave—I would like to say that while I have heard tank and drum heads called dished, saucer, round, concave, convex and even hemispherical, I go along with the widely accepted terms "external concave," "external convex."

A CANNON *Laurence Harbor, N. J.*

I ENTER THIS DISPUTE with trepidation because I must disagree with two men who heretofore I have regarded as infallible. Both the *ASME Code* and the *U.S. Marine Engineering Regulations* mention a head as either concave or convex *to the pressure;* no mention is made of what it looks like to the man outside the drum. All the insurance inspectors I've ever met would call this a "plus" head.

J E GLEASON *Plymouth, Mich.*
Evans Products Co

. . . SO WE TRIED THE AUTHORITIES*

To settle the question once and for all (?) we wrote a number of tank manufacturers to find out what they called tank head shown in the center of the cartoon above drawn by A Cannon.—ED.

WE SAY IT'S 'CONVEX': DOWNINGTOWN IRON WORKS, INC, Downingtown, Pa.; GODFREY-KEELER CO, New York 13, N. Y.; PATTERSON-KELLEY CO, INC, East Stroudsburg, Pa.; L O KOVEN & BROTHER, INC, Jersey City 7, N. J.; LAKESIDE BRIDGE & STEEL CO, Milwaukee 9, Wis.

WE SAY IT'S 'CONCAVE': A B FARQUHAR CO, York, Pa.; AMPCO METAL, INC, Milwaukee 46, Wis.; THE WICKES BOILER CO, Saginaw, Mich.

WE CALL IT A 'BUMPED HEAD': MURRAY IRON WORKS, Burlington, Iowa.

WE SAY 'DISHED-OUT' HEAD: LITTLEFORD BROS, INC, Cincinnati 2, Ohio.

WE CALL IT A 'PRESSURE TANK': HENDRICK MFG CO, Carbondale, Pa.

WE PREFER 'PLUS' HEAD: STRUTHERS WELLS CORP, Titusville, Pa.; WM BROS BOILER & MFG CO, Minneapolis 14, Minn.

NOTE: *The Hartford Steam Boiler Inspection and Insurance Co in their publication, "The Boiler Book," presents the following case for calling the head in question a "plus" head:*

"Much confusion has resulted in the use of the terms 'bumped,' 'dished,' 'concave' and 'convex' as applied to spherical heads of cylindrical vessels such as boilers, tanks, drums, etc. The terms 'bumped' and 'dished' are used interchangeably by many people and the terms 'concave' and 'convex' are not sufficiently definite unless some explanatory phrase is added to indicate whether the observer is supposed to be on the outside looking in, or on the inside looking out. In the case of a head which curves outwardly from the shell and which is concave to the pressure, the volume enclosed by the head is added to the volume of the shell, thus making a larger vessel than would be the case if a flat head were used; such heads are called 'plus' heads in our Engineering Dept. Similarly, if a head is convex to the pressure, curving inwardly from the shell, its volume will be subtracted from that which the vessel would have with a flat head and it would be called a 'minus' head."

Where Do You Buy Copper Mercuric Iodide?

IN HIS ARTICLE "Scale Seats Fast Now" (p 121, July, POWER) C Morgan Jones says, "Buy copper mercuric iodide at any paint store for indicating bearing or engine temperature."

Oh, yeah? I tried the paint stores here and they never heard of the stuff. Just where do you buy it?

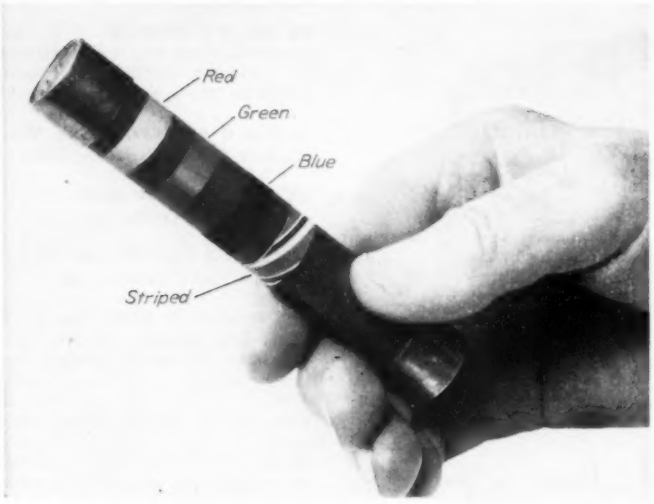
L L HEBBERD *Chicago, Ill.*

EDITOR'S NOTE: *After receiving several letters along the line of Mr Hebberd's, we tried paint stores here in New York.*

(*Continued on page* 202)

**They didn't agree either*—Ed.

PRACTICAL IDEAS... *here's the trading post for your*



SCOTCH TAPE MARKS FUSE RATINGS

IN OUR PLANT we work seven days a week around the clock. As chief electrician I work only one shift so it is the duty of the department foreman to replace blown fuses. They were not careful to read the ratings on the fuses they used, so sometimes circuits were overfused. Other times fuses of different ratings got into the same stockroom bin.

To overcome this trouble I used *Scotch* gift cellophane tape in different colors and set up a color code. For example, one size fuse in a given voltage rating would have a red band, another a green band, another a blue band, and another a striped band. Some of the different colors used are indicated in the photo.

Now all the foremen have to be sure of is that they replace a blown fuse with one of the same color band. The bands go all the way around so the foremen do not have to look very hard to be sure of the fuse size. It is also easy to keep fuses separated in bins. When I check the distribution and motor starting panels, it is also easy to see if a wrong fuse has been used.

C W FELTER *North Hoosick, N. Y.*

SCRAP-PILE KEEPS PLANT RUNNING

GET THE MACHINE RUNNING and keep it going. That must be the aim of every good maintenance man. Sometimes this leads to doing some pretty wild things, but the plant is kept producing and that's what counts.

Each section of paper machines in our mill is driven by a dc motor. Motor-driven rotary-drum contactors start the machine motors.

One of these starter motors burned out when we did not have a spare. To keep the machine running we started the section motor by hand. This did not work very well, because the machine had to be started several times a day, and required a competent man.

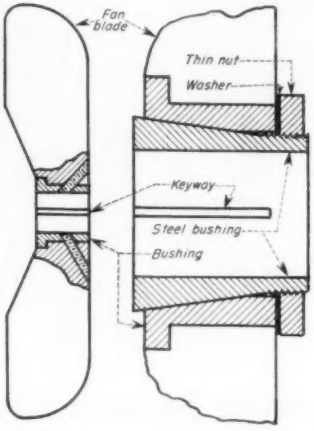
The contactor's rotating motor was rated 1/12 hp at 680 rpm. It was on the back of the starting panel and hard to get at. Also, the motor had to be replaced by one of the same size. When our stock of small motors failed to meet our needs we went to the scrap pile and found a motor frame of the right size.

We did not have an armature for this frame so made a shaft that extended beyond bearings. To one end of this shaft we connected the rotary contact drum and put a sheave on the other. Now we could drive the drum with a ⅓-hp, 1750 rpm motor which we had in stock.

Motor speed was about 2.5 times that of the drum's drive shaft, so we made two sheaves to give the right speed ratio. We put the larger one on the motor shaft and the smaller on the drive shaft. These we connected with a V-belt from the motor sitting on the floor.

This little trick worked as well as the original motor and kept the paper machine in full production until we got a new motor.

C N CARSON, JR. *Tyrone, Pa.*



Tapered Bushing Locks Fan to Motorshaft

WHEN THE FAN on the rotor of a totally enclosed motor could not be kept tight on the shaft the motor manufacturer gave us a new fan. This one soon got loose, probably because of vibration caused by a gear-driven conveyor.

A section through the fan looked like the left-hand drawing. The fan is an aluminum casting with a brass bushing, the assembly being keyed and setscrewed to the shaft.

To improve the fastening we enlarged the bore in the fan's hub and gave it a 5-deg taper, right-hand drawing. We made a steel bushing tapered on the outside to fit the fan's hub. On its inside the bushing fits the motorshaft. On its outer end, we threaded the bushing for a thin nut and then partly split the taper for the key. When assembled the taper locks to the shaft and key. This little trick did the job because the fan has remained tight on the shaft since the repair was made.

C HECKMAN *Boonville, Mo.*

operating and maintenance short cuts

FRED ANNETT, *Associate Editor*

DOLLY HANDLES OIL DRUMS EASILY

TO HAVE LUBRICATING OIL in a convenient place was a problem at a gas-compressor station. To handle full drums of oil took a lot of manpower, and was also an unsafe job. The operators solved the problem as in the photo. They made a drum rack, and built a platform dolly that can be rolled to one end of the rack. They cut a hole in the sheet-iron wall of the plant and laid an angle-iron track for the dolly to run on out to the end of the oil-drum rack.

Then the operators roll a full drum into the cradle on the dolly and push it into the plant, where it is located for easy use. The entire oil-drum handling equipment was made from junk pipe, angle iron and other material on hand. It saves time and labor and contributes to safety and good housekeeping in the plant.

DON ATTAWAY *Shreveport, La.*

TAGS HELP START NEW EQUIPMENT

A HIGH-PRESSURE high-temperature spreader-stoker-fired boiler was installed as an addition to a municipal plant. The older equipment included three 200-psi straight-tube boilers, two fired with underfeed stokers and one by a chain grate. Because of the difference in the old and new equipment the operators were a little afraid to take responsibility for the new.

The older units were in poor condition so it was necessary that the operators be trained as fast as possible to take over the new boiler. Even though we could instruct them to operate the spreader stokers and combustion control, it would take much longer training before they were competent to act in an emergency.

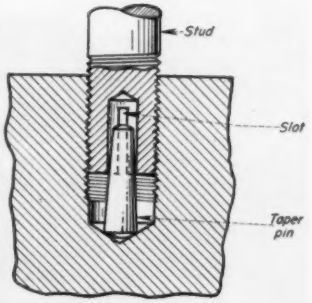
To solve this problem we used large white shipping tags. One tag was wired to the handwheel of each valve. On it we typed the kind of fluid in the line, name or purpose of the valve, and other information regarding the valve's operation. For example, the economizer bypass valve was marked: 1. Boiler Feedwater 2. Economizer Bypass Valve 3. To be used only when the flue gas is bypassed around the economizer.

This method worked well as it gave the operator a chance to learn what each valve was for without his having to ask what he might think were foolish questions. It also developed his confidence faster in operating the equipment than otherwise possible.

The shipping tags were durable enough to last through the breaking-in period. Additional cost of permanent metal tags was not justified as they would not be required after the operators learned their job.

Recently another company used similar tags during starting of a larger unit. The operators liked them in both plants so they can be recommended to others for starting-up instructions.

BRUCE L. STURDEVANT
Muscatine, Iowa



Tapered Pin Locks Stud In Threaded Hole

SEVERE VIBRATION may loosen studs used on heavy machinery. If the studs do not go through the metal they can be kept from working loose as in the drawing. Drill a hole in one end of the stud and slot it. Put a tapered pin in the hole in the stud and screw the latter in the hole. When the pin is forced against the bottom of the hole it expands the threads slightly causing a wedging action, which locks the stud in place.

ROGER ISETTS *Kenosha, Wis.*

Washes Grease and Dirt from Machine Parts

WHEN GETTING an idle plant ready for operation we had to clean an engine and several machines. Scrubbing with kerosene and emery cloth proved too slow so we rigged up three baths in two galvanized-steel wash tubs and half a wooden barrel.

In one tub we dissolved potash in water until the solution would float an egg. The other we filled with water. The half barrel we filled with a hydrochloric-acid and water solution. The solution was made strong enough so that gas bubbles formed on a piece of metal put in it for a few minutes.

We dismantled the machines and scraped the parts clean of grease and dirt and threw them into the alkali bath. We cut a scrub-brush in half and fastened a 2-ft handle to each half. These we used to scrub the parts.

When the parts were clean they were rinsed in the water and passed to the acid tub to remove the rust. After a final rinse the parts were wiped clean ready for assembly.

A G WIGGINS *Cleveland, O.*

(More PRACTICAL IDEAS on page 128)

Begins on page 126

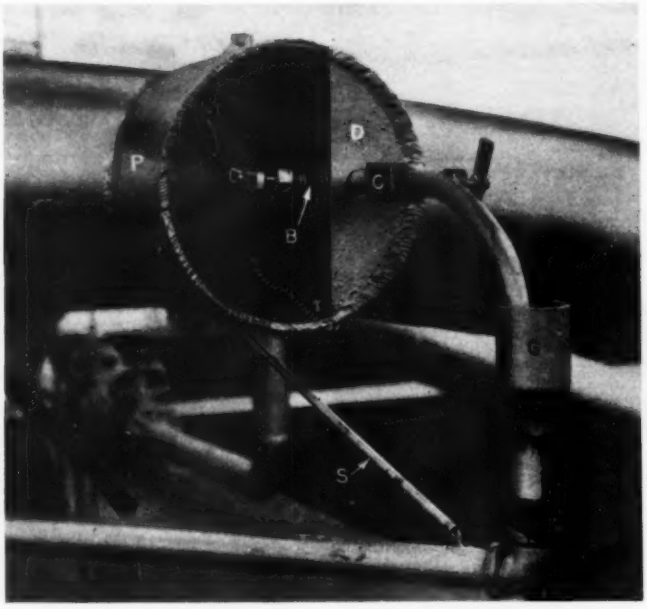


PLATE SUPPORTS SAMPLE LINE

WHEN SAMPLING the contents of a high-pressure line, the tap must be protected against breakage. Also to change the working or control valve in the tap line requires a block-gate valve.

In one plant a simple cover for the block valve and a support for the tap line was made as in the photo. A short section of pipe *P*, the same diameter as the main line, is welded around the tap line.

A disk segment *D*, with a hole in it for the tap line, is welded into *P*. The disk is so placed that its hole lines up with the tap line. The tap line is installed with its block valve *B* inside the segment and the control valve *C* outside.

The hole in the segment makes a close fit around the tap line, so that it is held from moving sidewise. This prevents breaking the line where it welds into the main.

From the working valve a curved nipple directs flow into the sampling vessel. When not in use the nipple's end is enclosed in a guard *G*. This guard is on the end of a short hinged pipe that leads to the plant's sump. A screen-door spring *S* holds the guard against the curved nipple unless forced away.

ELTON STERRETT *Houston, Tex.*

COMMUTATOR CARE AVOIDS TROUBLE

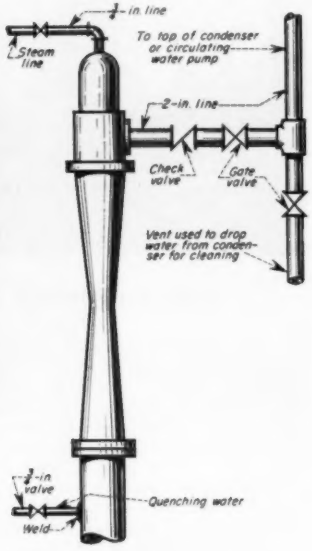
AS A RESULT of several years' experience grinding commutators on dc motors and generators we have learned several things. Copper and abrasive dust can cause a lot of trouble. This is especially true when it gets back of commutator risers, in armature slots and poleface windings.

To prevent this we use a heavy paper to make a hood over the commutator risers down to the bars. We glue the hood to the risers. Sometimes we put tape around the outer ends of the risers to help hold the hood in place. Where grinding is done on the commutator we place an exhaust fan near the grinder to help take away dust and send it outdoors.

It is necessary that mica on slotted commutators be kept below the surface of the bars. After slotting we use a V-shaped file to take out all mica near the top of the slots to get a good surface.

Much commutator trouble can be avoided by grinding with a stone made for the purpose—also by keeping slots clean and mica below the surface of the bars.

A G WIGGINS *Cleveland, O.*



Old Air-Ejector Nozzle Primes Condenser and Pump

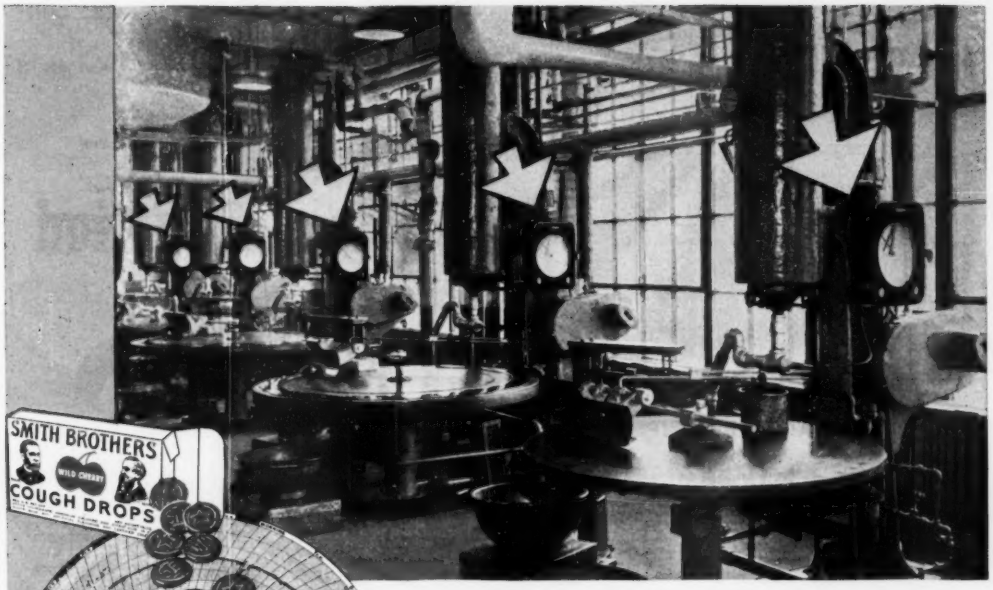
ALONG THE SEA COAST salt water is used for condenser circulating water. When steam turbines are put in service it is usually a problem to get the circulating water started. A steam siphon is slow because a large amount of air must be taken out of the condenser. Low tides make conditions worse.

Sometimes the air ejector is used to prime the condenser and pumps. This is not the best way because salt water may be pulled into the ejector.

We use one leg or nozzle of an old air ejector connected as in the drawing. The quenching water comes in below the venturi. It condenses the steam and also silences its noise going to the sump. The water is not sprayed into the steam. The water stream striking the opposite side of the pipe probably forms an effective spray. Water pressure is about 70 psi, and steam 235 psi.

A W SHEPHERD *San Diego, Calif.*

(More PRACTICAL IDEAS on page 130)



Cooking of the "World's Best-Tasting Cough Medication" Is Automatically Regulated by

POWERS

Temperature Recording Regulators

They Save Labor—Help Insure Uniform QUALITY

For 104 years Smith Brothers cough drops have been famous for good flavor by seekers of cough relief. When Smith Brothers sought relief from the errors and losses of manual control of cooking operations they installed Powers Recording Regulators in their plants at Michigan City, Ind. and Poughkeepsie, N. Y.

When you want better temperature or humidity control for

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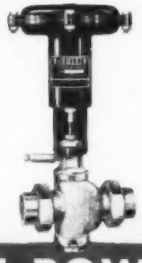
DRYERS, drying, curing or chilling rooms • COOKING tanks, vats, retorts or kettles • WATER TEMPERATURE CONTROL—for every requirement

. . . contact your nearest Powers Office. There's no obligation. With 60 years of experience and a wide variety of self operating and pneumatic controls we may be able to help you select the best equipment for your requirements.

(59CD)

Temperature Chart shown above indicates type of control obtained at Smith Brothers with Powers Recording Temperature Regulators.

At right: Powers FLOW-RITE Diaphragm Valve.



THE POWERS REGULATOR CO.

Over 55 Years of Pneumatic Temperature Control • Offices in Over 50 Cities • See Your Phone Book

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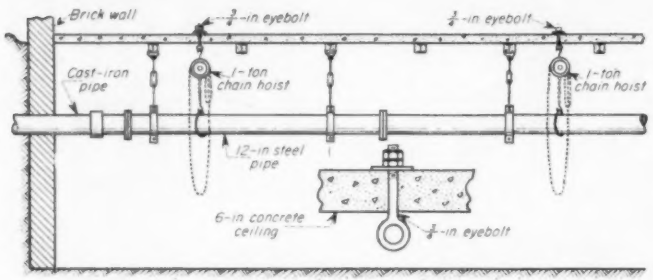
TORONTO, ONT., 195 Spadina Ave. • FACTORY & GENERAL OFFICES, Skokie, Ill.

More PRACTICAL IDEAS

Begins on page 126



REPLACES BIG PIPE IN A HURRY

WE HAD TO REPLACE six 20-ft lengths of 12-in. steel pipe. The line had been in cold-water service for about 20 years under 75- to 100-psi pressure. To lower the old pipe from the ceiling and raise the new one we used the method in the diagram.

With an air drill we drilled 1-in. holes through the 6-in. concrete floor above the old pipe. In the hole we put a ¾-in. eyebolt to which we connected two chain hoists to handle two lengths of pipe at a time.

To locate the eyebolt holes correctly we measured from building-end and side walls to the pipe in the basement and transferred these measurements to the floor above. To speed up replacing the old pipe, everything possible was done to make the going easy before the job was started. The new pipe was put in place under the old and bolted up in 40-ft lengths.

All bolts in flanges that had to be opened in the old pipes were replaced one at a time by new ones. This insured that we would not be tied up with rusted-in bolts when we started to take down the old pipe. The bolts were also loosened in the pipe-hanger straps.

To replace the pipe, weight of a 40-ft section was taken on the two chain falls. Then bolts were taken from flanges and supporting clamps and the section lowered and a new one raised into its place. To do the complete job we had the line out of service only a few hours. To close the holes in the floor we drove short wooden plugs up into them from below and poured concrete in from the top.

ART BELTON *Montreal, Que.*

Short Piston Causes Noise In Reciprocating Pump

A DUPLEX DIRECT-ACTING boiler-feed pump ran quietly at low speed, but became noisy at normal speed. When I was called on the job the pump made a heavy thump in one steam cylinder.

I learned from the engineer that the piston in this cylinder had been replaced a few weeks before. Looking at the old piston I found it cracked at the taper. I also found that the new piston was ¼ in. shorter than the old one. This suggested the cause of the noise.

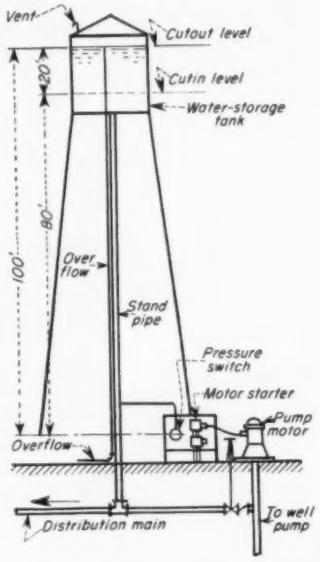
The short piston increased the clearance and reduced the compression. At low speed, pressure in the cylinder was not high enough to require high compression for quiet operation. But at high speed without high compression, the pump pounded.

We put the piston rod in a lathe and turned its taper so the piston could go no farther. From a piece of plate steel we made a disk the size of the piston. This made the new piston the same length as the old one. When the pump was again put in service it ran quietly at all speeds.

A G WIGGINS *Cleveland, O.*

Mercury Switch Control Elevated-Tank Water Level

WE HAD THE PROBLEM of keeping a water-storage tank full from a deep-well. Drawing shows general arrangement of the storage tank and pump. Since friction losses in the stand pipe to the tank are practically zero we decided to use a mercury pressure switch



to stop and to start the pump motor.

On this installation from the center line of the switch on the control panel it was 100 ft to the high-water level in the storage tank, as shown. This made cutout pressure equal to $100 \div 2.3 = 43.3$ psi. We allowed a 20-ft draw-down in the tank so water level would be $100 - 20 = 80$ ft above the pressure switch. This made cutin pressure equal $80 \div 2.3 = 34.6$ psi.

The switch we selected had an adjustable pressure range from 1 to 60 psi. We set it to cut in at 35 psi and out at 43 psi. This gave us about the water levels we wanted in the tank.

J D CONSTANCE *Cliffside Park, N.J.*

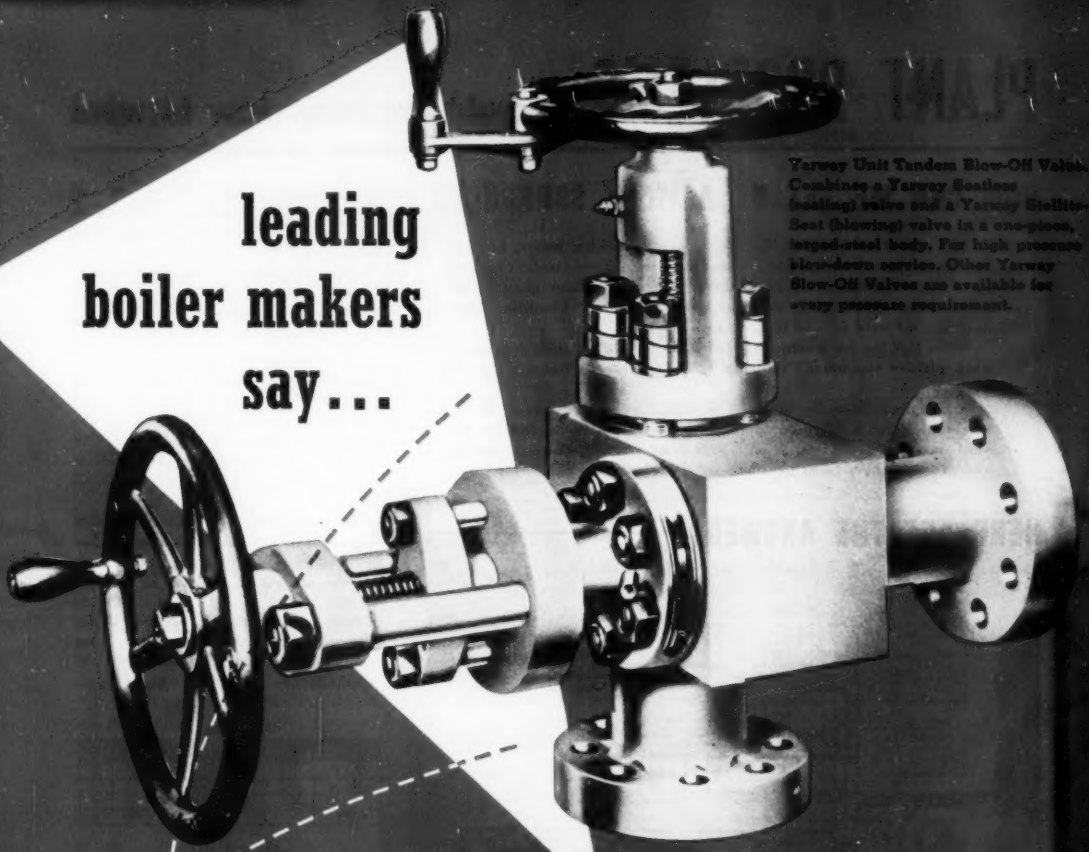
Welding Repairs Blind Leak in Large Pipe

A LEAK STARTED in a 4-in. cold-water vertical pipe close to a cement-block wall. As luck would have it, the leak was on the back of the pipe hard against the wall. To renew this section of the pipe would have been a tough and costly job.

With a cutting torch we cut a piece out of the front of the pipe opposite the leak, then welded the leak through the hole. To complete the job we welded the piece back in place. Quite simple—and it saved us a lot of hard work.

FRED C MACMAHON *West Belmar, N. J.*

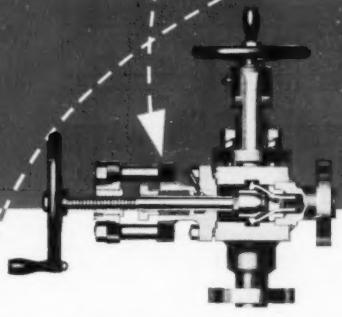
leading boiler makers say...



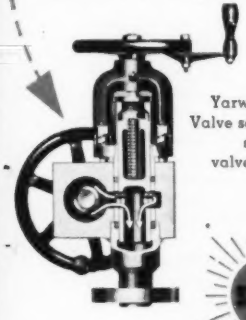
Yarway Unit Tandem Blow-Off Valve. Combines a Yarway Seatless (sealing) valve and a Yarway Stellite-Seat (blowing) valve in a one-piece, forged-steel body. For high pressure blow-down service. Other Yarway Blow-Off Valves are available for every pressure requirement.

YARWAY

BLOW-OFF VALVES



Yarway Unit Tandem Valve sectioned through stellite-seat (blowing) valve. Open position.



Yarway Unit Tandem Valve sectioned through seatless (sealing) valve. Open position.

Leading steam boiler makers (names on request) standardize on Yarway Blow-Off Valves . . . for the same reasons that over 15,000 plants use them:

- UNIQUE DESIGN
- MODERN METALLURGY
- RUGGED CONSTRUCTION

} TROUBLE-FREE SERVICE

How these features will help your boiler operation is clearly explained in Yarway Blow-Off Valve Bulletins. Write for one, telling us your operating pressures.

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STOP ***BLOW-DOWN TROUBLES...KEEP BOILERS ON THE GO***

PLANT PROBLEMS ... *put your know-how to work*

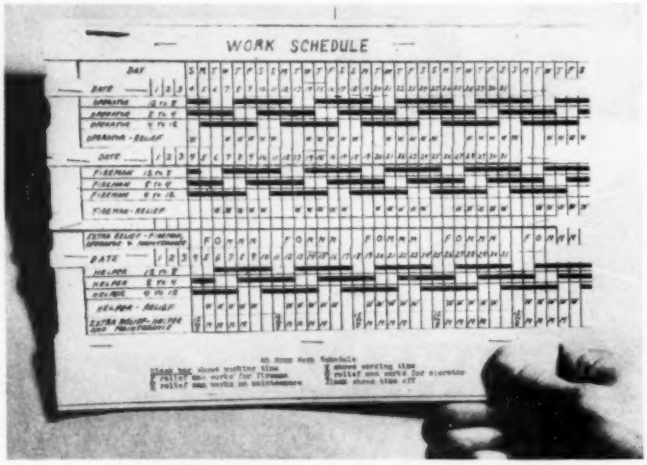
HOW CAN WE SET UP A WORK SCHEDULE?

HERE ARE THE FACTS: We are changing working hours, holiday and vacation schedules for reasons beyond our control. Changes upset shift schedules; we must restudy crews for every change. At times we have too many men; at others, too few. Condition isn't healthy and we'd like to clear it up.

We're looking for a schedule that takes care of all shift operators' work without too much "figuring." We operate 24 hours a day, 7 days a week.

Is there any formula or chart to figure work schedules? We're not looking for a schedule that fits only one set of conditions; we want one that gives best results with least trouble when personnel and other changes must be made—*WB*, July POWER.

HERE ARE THE ANSWERS



CARL TRETINYAK'S slide-rule work schedule saves time

SLIDE-RULE SCHEDULE. Here's our own method of setting up and changing work schedules that really works. Photo above shows the slide rule we use. Different shifts are laid out on slides arranged to move in or out of the stationary plastic protector. Other strips, containing day of week and date, guide the sliding strips. If plant work schedule is set for a 4-week period, slides are made long enough so work for a 5-week period can be figured. Then we see all possible changes for the work period as the slides are manipulated.

Slides in the 40-hour schedule shown are arranged like this from top to bottom of the rule: (1) slide showing day of week (2) stationary date spacer (3) slide showing three regular-shift operators (4) slide showing relief operator (5) stationary date spacer (6) slide for three regular-shift fireman (7) slide for relief fireman (8) ruled spacer strip (9) slide for extra relief operator-fireman-maintenance man (10) stationary date spacer (11) slide for three regular shift helpers (12) slide for relief helper (13) slide for extra relief helper-maintenance man.

Note on this schedule the three operators are shown on one slide, the three firemen and three helpers on other slides. A separate slide may be set up for each shift if more changes are needed.

To use, the shift scales are lined up with the desired date and day of week. Then variables like relief men and extra relief men are manipulated to properly fit the schedule. This is done by moving the corresponding slide in or out. Extra slides with different work schedules can be kept on hand and substituted.

CARL TRETINYAK *Austin, Minn.*

SPECIFIC SCHEDULE BEST. Work up separate schedule for each change and you'll save many headaches. We prepare a vacation schedule after giving all men an opportunity to choose dates they prefer. Individual wishes are followed as closely as possible. Any changes requested after schedule is made up must fit in, or they aren't allowed.

We're required to give a man an extra day off within 30 days when a holiday falls on his regular day off. Before each holiday we ask a man which day he prefers and make up our schedule to include his choice. This system works because each man knows exactly where he stands.

K M WHITE *Linn, Mo.*

FIRST WEEK

	M	T	W	T	F	S	S
12-8	1	1	2	2	2	2	2
8-4	3	3	3	3	1	1	1
4-12	4	4	4	4	4	4	3
Off	2	2	1	1	3	3	4

SECOND WEEK

	M	T	W	T	F	S	S
12-8	2	2	4	4	4	4	4
8-4	1	1	1	1	2	2	2
4-12	3	3	3	3	3	3	1
Off	4	4	2	2	1	1	3

THIRD WEEK

	M	T	W	T	F	S	S
12-8	4	4	3	3	3	3	3
8-4	2	2	2	2	4	4	4
4-12	1	1	1	1	1	1	2
Off	3	3	4	4	2	2	1

FOURTH WEEK

	M	T	W	T	F	S	S
12-8	3	3	1	1	1	1	1
8-4	4	4	4	4	3	3	3
4-12	2	2	2	2	2	2	4
Off	1	1	3	3	4	4	2

TALBOTT'S schedule

PAID BY HOUR. We pay our men for number of hours worked, using schedule in sketch above. Each shift is given a number with working hours as shown. Whenever someone is given time off for sickness, etc, a man who would be off that day fills in. Maintenance work and boiler cleaning are done by men who have a day off. Since everyone is paid for hours worked there is a fair distribution of time and earnings.

W R TALBOTT *Baltimore, Md.*

help the other guy cure his headaches

TYLER HICKS, *Assistant Editor*

	SUN	MON	TUES	WED	THURS	FRI	SAT
12-8	C	C	D	D	D	D	D
8-4	A	A	A	A	A	B	B
4-12	B	B	B	B	C	C	C
12-8	D	D	A	A	A	A	A
8-4	B	B	B	B	B	C	C
4-12	C	C	C	C	D	D	D
12-8	A	A	B	B	B	B	B
8-4	C	C	C	C	C	D	D
4-12	D	D	D	D	A	A	A
12-8	B	B	C	C	C	C	C
8-4	D	D	D	D	D	A	A
4-12	A	A	A	A	B	B	B

R L HEIN'S schedule is simple, flexible

	MON	TUES	WED	THURS	FRI	SAT	SUN
DAY SHIFT	Spare on (A off) B Spare on (C off) D	A Spare on (B off) C Spare on (D off)	A B C D	A B C D	A B C D	A B C D	A B C D
AFTER-NOON SHIFT	E F G H	E F G H	E F G H	E F G H	Spare on (E off) F Spare on (G off) H	E Spare on (F off) G Spare on (H off)	E F } Both spares off G H
NIGHT SHIFT	J K L M	J K L M	Spare on (J off) K Spare on (L off) M	J Spare on (K off) L Spare on (M off)	J K L M	J K L M	J K L M

A, E and J are shift foremen *C, G and L are firemen*
B, F and K are watertenders *D, H and M are turbine operators*

R A LANE allows for sickness and absenteeism

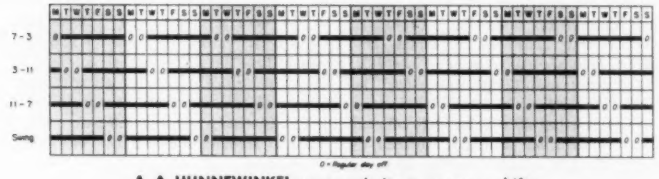
HAD SAME EXPERIENCE. We tried to arrange a simple but flexible schedule. Working hours were fixed but personnel could be easily changed on each shift.

By studying our schedule, top sketch, you see that each shift works three 40-hr and one 48-hr week in any one pay period. Schedule repeats itself every fourth week. In the near future we will transfer all personnel to a 40-hr week. With our present schedule the fifth and sixth days of the fourth week for any shift are worked between 8 am and 4 pm. We plan to relieve the shift with operators who normally work in the maintenance crew. This is a most desirable arrangement because some operators and maintenance men do both types of work and become familiar with the others' problems.

R L HEIN *Humboldt, Iowa*

					8-4	4-12	12-8	Off				
Apr 16	May 14	June 11	July 9	M	C	D	A	B	Aug 6	Sept 3	Oct 1	Oct 29
17	15	12	10	T	C	D	A	B	7	4	2	30
18	16	13	11	W	C	D	B	A	8	5	3	31
19	17	14	12	T	C	D	B	A	9	6	4	Nov 1
20	18	15	13	F	C	A	B	D	10	7	5	2
21	19	16	14	S	D	A	B	C	11	8	6	3
22	20	17	15	S	D	A	B	C	12	9	7	4
23	21	18	16	M	D	A	B	C	13	10	8	5
24	22	19	17	T	D	A	B	C	14	11	9	6
25	23	20	18	W	D	A	C	B	15	12	10	7
26	24	21	19	T	D	A	C	B	16	13	11	8
27	25	22	20	F	D	B	C	A	17	14	12	9
28	26	23	21	S	A	B	C	D	18	15	13	10
29	27	24	22	S	A	B	C	D	19	16	14	11
30	28	25	23	M	A	B	C	D	20	17	15	12
May 1	29	26	24	T	A	B	C	D	21	18	16	13
2	30	27	25	W	A	B	D	C	22	19	17	14
3	31	28	26	T	A	B	D	C	23	20	18	15
4	June 1	29	27	F	A	C	D	B	24	21	19	16
5	2	30	28	S	B	C	D	A	25	22	20	17
6	3	July 1	29	S	B	C	D	A	26	23	21	18
7	4	2	30	M	B	C	D	A	27	24	22	19
8	5	3	31	T	B	C	D	A	28	25	23	20
9	6	4	Aug 1	W	B	C	A	D	29	26	24	21
10	7	5	2	T	B	C	A	D	30	27	25	22
11	8	6	3	F	B	D	A	C	31	28	26	23
12	9	7	4	S	C	D	A	B	Sept 1	29	27	24
13	10	8	5	S	C	D	A	B	2	30	28	25

S R GREEN'S schedule runs for 32 weeks, saves work



A A HUNNEWINKEL uses seniority to arrange shifts

ONE DAY OFF. Schedule, sketch above, gives each man one day off per week. Two spare men are needed to work this plan. Also, several other men are needed to fill in for sickness, etc. We have one fireman who does this, and we also carry two men on the repair gang who can be shifted to operating duties on short notice. This scheme of reserve personnel really pays off when sickness and other causes of absenteeism hit your plant. (Sketch, top right.)

R A LANE *Three Rivers, Que.*

32-WEEK SCHEDULE. On each shift a man works seven days on the 12 to 8, then has two days off. Sketch, left. From there he goes to the 4 to 12 for seven days, then has one day off. After this he works seven days on the 8 to 4, and has four days off before returning to the 12 to 8. Schedule shows this setup for part of 1951.

S R GREEN *Trona, Calif.*

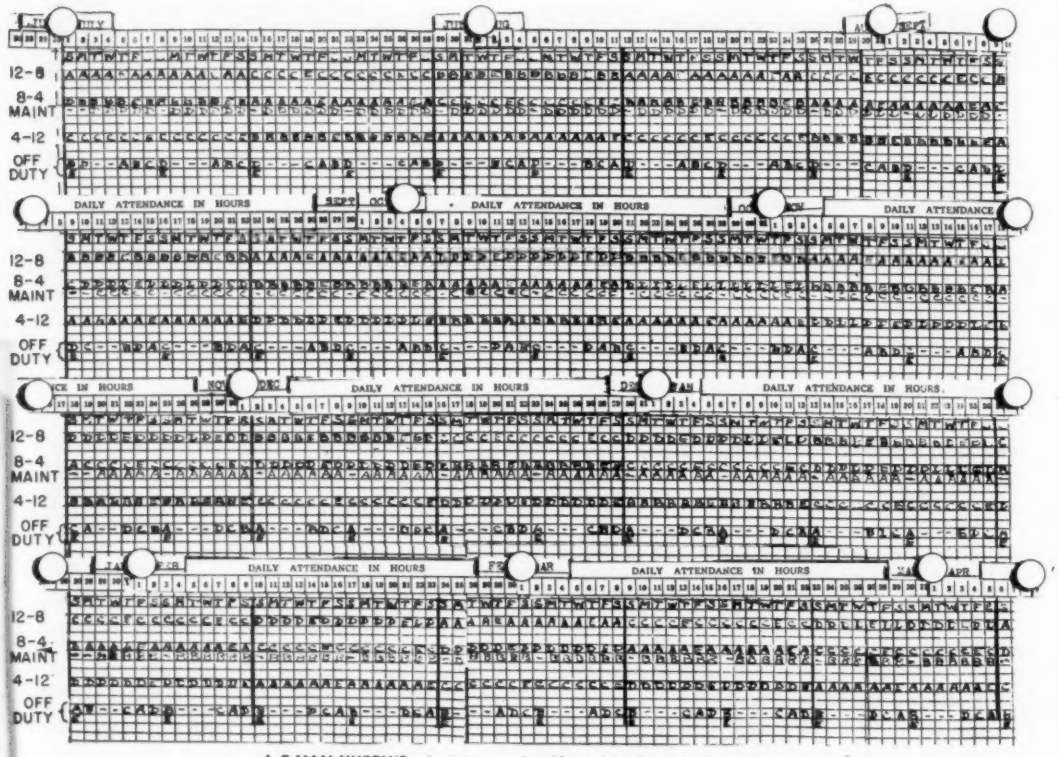
SENIORITY DECIDES. We have used schedule in sketch, left, five years with excellent results. Department seniority fixes choice of men for each shift. Each man works two 48-hr weeks in the 8-week cycle.

A A HUNNEWINKEL *Woodstock, Ill.*

(*Continued on page 134*)

More PLANT PROBLEMS

Begins on page 132



L C VAN HUBEN'S schedule runs for 40 weeks, after which it repeats

HOSPITAL SCHEDULE. We operate 24 hr per day, 365 days per year, and have sufficient power and refrigeration equipment to make the plant what you might call typical. We have five boilers, one turbine, three steam engines, two refrigeration compressors. Five shifts, each of four men, operate the plant.

Sketch above shows our schedule. It is made up for 40 weeks, when it repeats itself. Shifts are labeled *A*, *B*, *C*, *D* and *E*. First four, on a rotating schedule, perform regular duties. *E* shift is the relief, works as a unit to relieve the three watch shifts one day per week. Maintenance work is done by *E* shift on the other three days. To compensate for short changes during relief work and for the "cut-up" week, *E* shift has Sunday off the year round.

Three of the other four shifts rotate. Two weeks elapse between changes. Fourth shift is assigned to repairs and maintenance for ten weeks, after which it replaces one of those on the rotating schedule. Relieved shift then takes its turn at maintenance, has Sunday off. While on maintenance no watch work is done except for vacations or emergencies.

You'll see from our schedule that when changing from maintenance to watch work some shifts start in morning, some in afternoon, some at night. You avoid this unfairness by cutting maintenance period to eight weeks.

To save making a new chart every 40 weeks, we made a set of circular tapes bearing numbered days of the month. These are arranged so any sequence of months like 30-31-30-31, etc, can be obtained. One tape has a sequence for February, the short month, and another for leap year. Tapes are tacked onto chart as in sketch and month tabs spotted at proper intervals. Only tapes and month tabs need be shifted at end of 40 weeks.

Our crew has 52 regular days off and 20 days vacation annually. Instead of holidays, shift workers receive 10 extra days every year, a total of 82 days. To make time keeping easier we credit five days off for each month worked except December and June when six days are credited. This makes 62 days off.

I've used this schedule more than five years in two plants without trouble. Advantages are: (1) Every employe gets the same breaks in job assignments. (2) Every man has an equal number of Sundays and weekdays off in each 40 weeks. (3) Everyone sees at a glance just what hours and duty he'll work. (4) There's always a full shift on hand for five days the first week, and six days the other nine weeks. During vacations or emergencies the man of equal title on maintenance takes the shift position of the man on leave. (5) There's an extra shift (relief) on hand for maintenance three days a week throughout the year. (6) Since duties for all with the same title are identical, except for relief shift, changes in schedule are easily made by transferring men from one shift to another.

L C VAN HUBEN *Orangeburg, N. Y.*

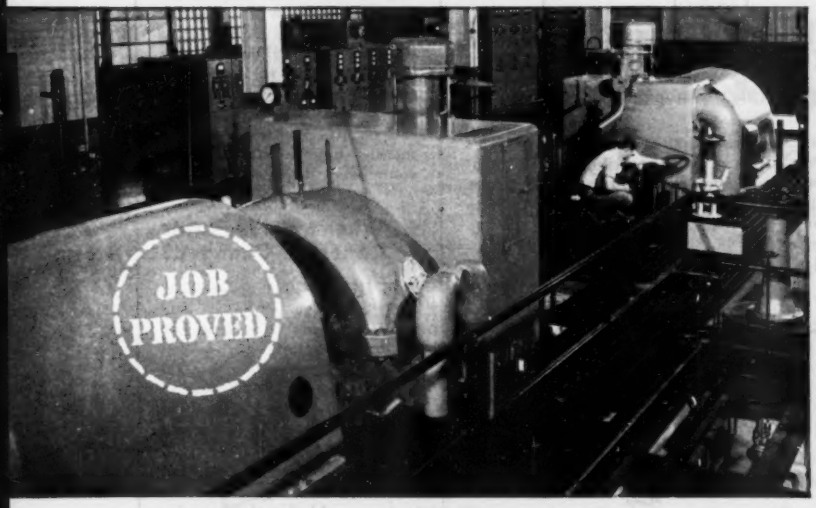
Chas. Pfizer & Co., Inc., is the discoverer and sole manufacturer of terramycin, the newest "wonder drug," which has proved effective in the treatment of *more than 50 acute infections.* Pfizer is the world's largest producer of antibiotics and a leading producer of synthetic Vitamin A.

Power—lots of it and never failing—is needed by Pfizer's modern plant at Groton, Conn., to safeguard round-the-clock production. The plant relies entirely upon its two steam turbines for power, light, and refrigeration. For the utmost protection, "Job Proved" Sunvis 916 Oil was chosen as the lubricant for these turbines when installed—two years ago. This Sunvis 916 has been in continuous service ever since. As expected, inspections show the turbines free from rust, sludge, and corrosion; and laboratory tests show the oil ready for thousands of hours of continued service.

Sunvis 900 Series Oils are unsurpassed as turbine lubricants. Under normal operating conditions they will be *good for the life of your turbines.* For complete information, telephone the Sun Office nearest to you or write Department P-10.

TERRAMYCIN being processed as an elixir, a new dosage form in which this "wonder drug" is more easily taken by infants and old people. The work is carried on in a sterile air-conditioned room.

POWER FOR "WONDER DRUG" PRODUCTION PROTECTED BY SUNVIS TURBINE OIL



TWO 2,500 KW TURBINES, each charged with 300 gallons of Sunvis 916 Oil, generate all of the plant's power. The condensing-extraction unit has been running over 15,000 hours, the back-pressure unit over 7,000 hours.

THE LUBRICATING OIL flows continuously through a layer of wool, then a tank of water, and finally a triple bag filter. Recent tests at Sun's laboratories show that the oil is in excellent condition, and good for thousands of hours more.

SUN INDUSTRIAL PRODUCTS

SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

SUNOCO®

More PLANT PROBLEMS

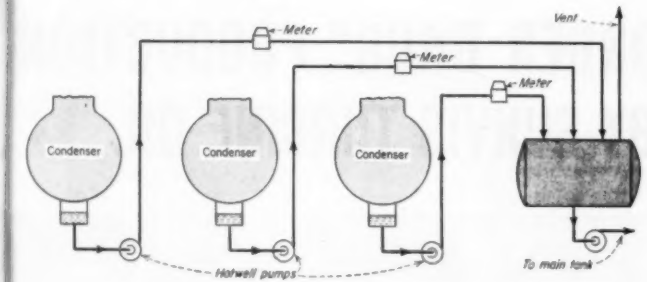
Begins on page 132

HOW CAN WE METER CONDENSATE RETURNS?

HERE ARE THE FACTS: I'm in charge of a process-steam plant where almost 100% of condensate is returned to the boiler room. It comes from vats, drying rolls, air-conditioning units, steam-heating system in one building, and several other sources. We meter steam flow out of boiler room but have trouble getting accurate readings on condensate. Meters we've tried have registered steam or been damaged by it.

How can rotary or tilting condensate meters be piped to protect them from damage and incorrect readings? What about volumetric meters? How should we connect meters to pressure, gravity and vacuum return lines? We need good hookup sketches—*JA*, July POWER.

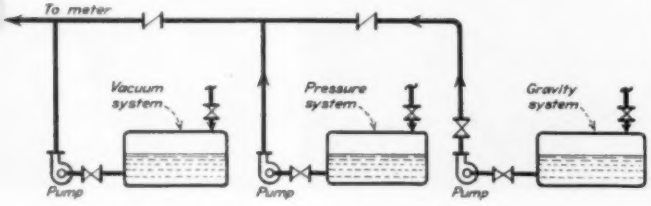
HERE ARE THE ANSWERS



VINCENT STROJSA got good results with this hookup

HAD SAME PROBLEM. We had to find steam rates of three old condensing turbines of different capacities. We piped all drains to the condenser hotwells and pumped condensate from there to a storage tank. Between condensate pump discharge and storage tank we fitted a disk-type water meter as above. This allowed us to measure steam rate of each turbine. Accurate readings were obtained; results checked closely with our boiler meters. *JA* can use a setup like this.

VINCENT STROJSA *Glace Bay, N. S.*



R A LANE suggests metering condensate after it's collected

USE RETURN TANKS. If *JA* needs to measure only the total quantity of his returns and if he has individual return tanks for each system, he can pump into a common line as above. Meter we use is orifice-plate type but this scheme might work with a disk-type unit, too. See meter manufacturer for right place to put meter in pipe. Then readings will be accurate for all flows.

R A LANE *Three Rivers, Que.*

(*Continued on page 204*)

YOUR NEW PROBLEMS

Will you help these two readers who have sent us their problems? Published answers are paid for. Extra for photos or sketches.

1 How Can We Keep Leather Belt Tight?

ONE OF OUR belt drives is giving us serious trouble. Here's how it sets up. A 90-in. diameter pulley drives a 20-in. diameter pulley through a 24-in.-wide double leather belt. Pulleys are on 21-ft centers. To transmit the maximum load of about 135 hp the belt must be very tight or it will slip.

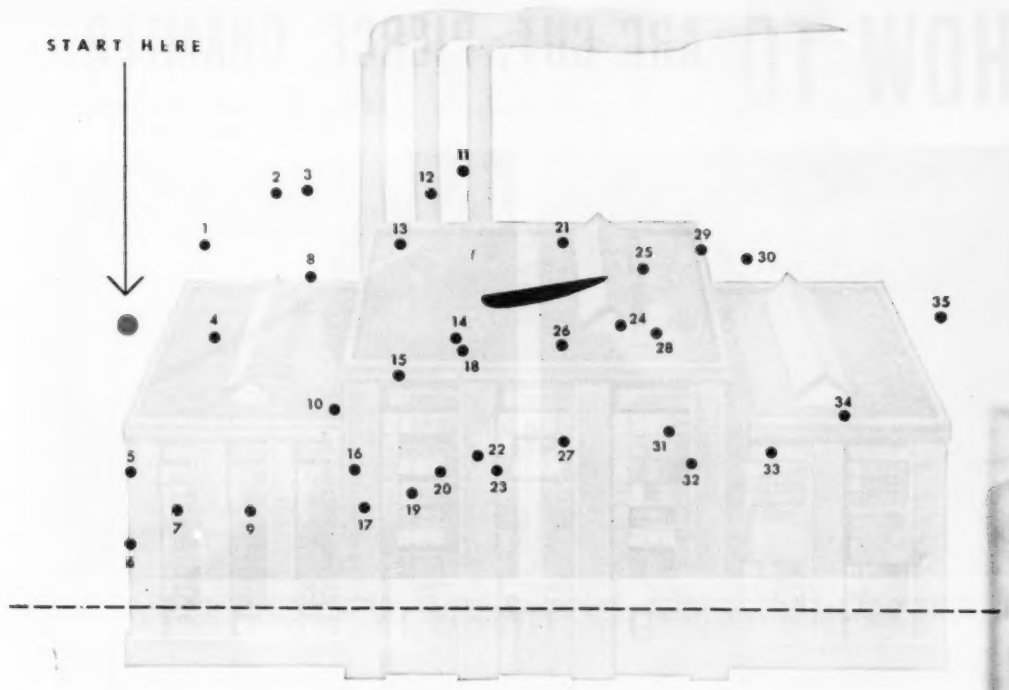
When carrying a heavy load the two belt plies always separate. A shutdown is necessary that stops production while we repair the belt.

An engineer in a nearby plant suggests a second belt over the one that splits; then we can run with the inner belt slack and the outer one tight. Will this work? If so, how wide should outer belt be? How much slack should we allow in inner belt? Or is there a better way of transmitting needed hp? How would you do it? We need sketches showing how we can get right power from drive.—*JM*

2 When Must Elevator Ropes Be Changed?

THE BUILDING I operate has eight passenger elevators and two freight cars. Rope renewals on these elevators is a problem that has always worried me. I'd like help from POWER readers who have had elevator maintenance experience. Here are my questions:

How often should elevator and hoist ropes be inspected? What is a reasonable length of service for these ropes? What's the best method for finding out when they should be renewed? Are there any rigs that speed the renewal job? We sell old ropes as scrap. Is there any better use for them?—*BF*



This puzzle may solve a plant puzzle for you!

This is The BETZ INDICATOR, a monthly publication devoted to general discussion of all water problems. It's free. Write.

Water for industrial use can . . . and usually does . . . pose an infinite variety of unidentical problems. Variables include the water itself, the plant equipment, the operating conditions and a host of other factors. The proper approach to the solution of a water treatment problem . . . however puzzling . . . is to engage specialists who provide an adequate and well-balanced program of scientific control.

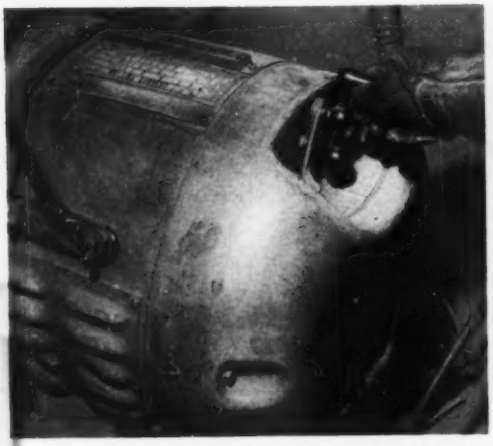
BETZ is a nationwide service organization specializing in the solution of all water problems. We offer a complete water conditioning service that is scientifically correct—designed to help you maintain all-out production. If the results you are presently obtaining are not entirely satisfactory, let us explain how our specialized service can help you. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Penna. In Canada: BETZ Laboratories Limited, Montreal, 1.

BETZ

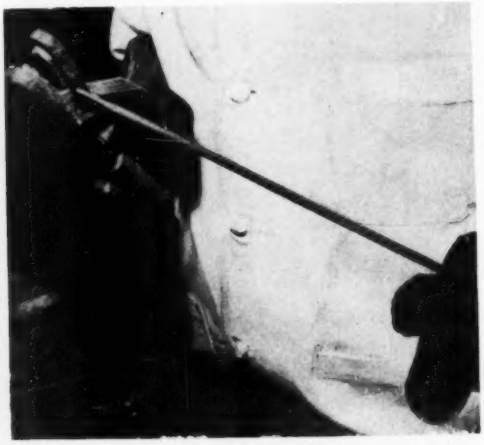
BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

HOW TO ARC CUT, PIERCE, CHAMFER

By R D WASSERMAN, *Eutectic Welding Alloys Corp*

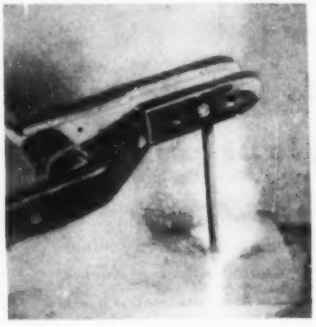


1 Set amperage within range shown on electrode. Exact ac or dc straight polarity depends on the size and type of work

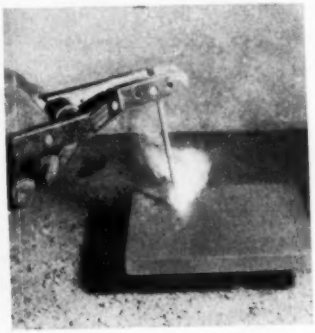


2 Insert this oxygenless cutting electrode into an ordinary electrode holder. No oxygen tanks or special holder here

3 To gouge metal, or rout out portions, hold electrode at 10 to 20 deg angle



4 To cut, hold at 45 deg angle. Move electrode up, down in sawing motion



5 To pierce or "drill holes" fast, hold vertically and jam through the metal

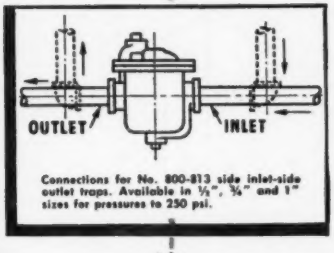
6 Buried for 75 years, water pipe was cut up quickly, though badly rusted

NOW YOU CAN CUT such hard-to-saw metals as nickel, monel, Inconel, copper, brass, bronze, even aluminum, stainless steel and cast iron. And you don't need gas tanks, valves, regulators, hoses, special holders or cutting torches.

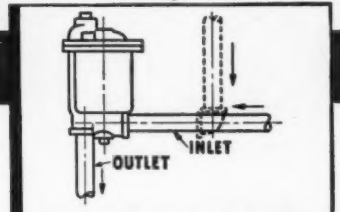
Not only is this cutting electrode a simple tool for cutting cast iron. It also chamfers sections preparatory to welding. Where it usually takes a skilled "burner" to handle the oxy-acetylene torch, anyone who uses electrodes can do "arc cutting." Only difference between electric arc welding and oxygenless arc cutting is that these cutting electrodes withstand higher cutting amperages. They concentrate the arc's heat and force right at point of cut for best results. This cutting electrode can be used with any ac or dc arc-welding machine. Move electrode in a sawing motion so molten metal is continuously blown out of cut by forward motion of arc.

YOU SAVE
TIME AND MONEY

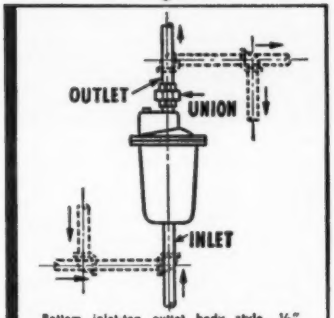
"This choice of
Steam Trap Body Styles
simplifies
installations"



Connections for No. 800-813 side inlet-side outlet traps. Available in ½", ¾" and 1" sizes for pressures to 250 psi.



Side inlet-bottom outlet trap, ½" or ¾". Greatly simplifies connections to many types of small steam-consuming units.



Bottom inlet-top outlet body style. ½" through 2" connections. Cast semi-steel bodies for pressures to 250 psi. Forged steel bodies for pressures to 1500 psi.

IN THE most widely used sizes, Armstrong Steam Traps are available in either side inlet-side outlet or bottom inlet-top outlet body styles. This gives the user an opportunity to make exceptionally neat installations with a minimum of fittings and a minimum of labor and permits correct location of the trap in relation to the unit being drained.

In both styles the entire interior mechanism may be taken out for inspection or repair simply by removing the cap. The body, full of boiling water, is left in the line. In the case of the side inlet trap the cap may be removed without even disturbing the pipe connections.

Ask your nearby Armstrong representative to show you the opportunities for simplifying trap installations.

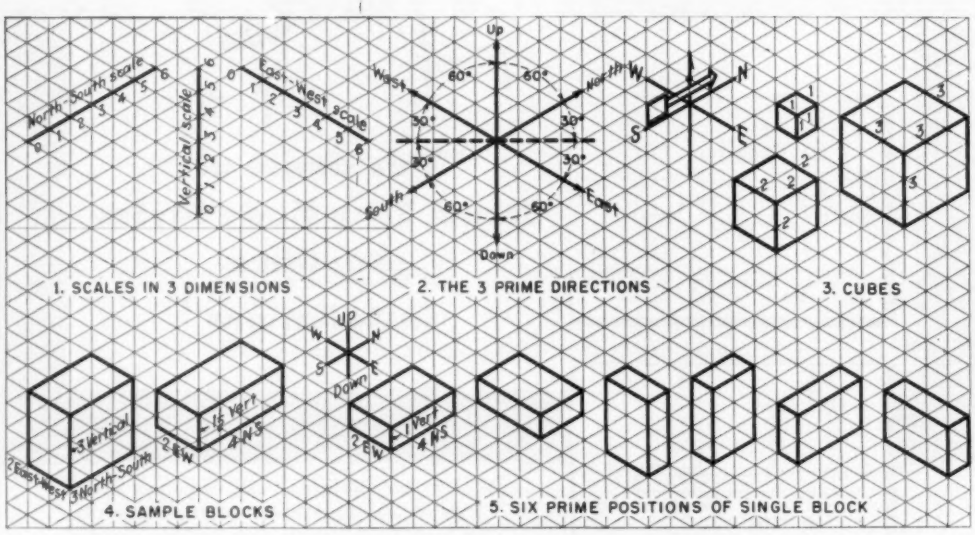
ARMSTRONG MACHINE WORKS
812 Maple St., Three Rivers, Mich.

THE 36-PAGE ARMSTRONG STEAM TRAP BOOK gives data and prices on the complete line of Armstrong steam traps for every pressure, every application. This book is a valuable reference for the calculation of condensate loads and the selection of traps for all classes of equipment. Send for free copy today

ARMSTRONG STEAM TRAPS

HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH



Isometric Sketching-1

► AGAIN AND AGAIN it happens that the engineer in charge of a plant faces the need to show a mechanic (or maybe the management) what some proposed gadget or construction will look like.

What can he do if neither the mechanic nor the management, as often happens, can read an ordinary blueprint showing top and side views?

Picture Drawing. The kind of perspective sketch architects make of new buildings would do the trick, but perspectives are too complicated and expensive for everyday engineering work.

Nine times out of ten the answer is an "isometric" sketch—the kind you see often in the pages of POWER.

Isometric is a form of picture drawing that's ideal for practical engineers. First, an isometric looks so much like the actual object that almost anybody can recognize it at first glance. Second, isometrics are mighty easy to draw. These articles will show you how.

Isometric can be used for any kind of object, but it works out best for objects like buildings, piping systems and square-cornered blocks, where the main lines run in the three prime directions (each at right angles with other two).

Three Prime Directions. In a case like that you imagine the object turned so its three main directions match the three prime directions of nature: vertical, north-south and east-west.

All examples in this series will be sketched on isometric plotting paper to save work. You can buy isometric paper from leading drafting supply houses. Keuffer and Esser, 1237 Fulton St, New York City, for instance, have Form 358-29 (the 8½x11 in. sheet, punched, grid drawn on ¼-in. scale) or Form 342 C (the 13x19 in. sheet).

On these sheets vertical lines stand for lines that are vertical in the object. One set of lines sloping up 30 deg stands for north-south lines in the object. The other set of sloping lines stands for east-west lines in object.

You measure with the same scale in all three directions. That's why they call it "isometric" (equal measure). Take one unit on the grid as any desired distance—a quarter inch, half inch, inch, foot, or anything else you want.

Fig. 1 shows how to measure off any number of units in any of these three prime directions. The prime directions are shown again in Fig. 2. Weather vane in Fig. 2 will help you picture what you're doing.

Until you get used to isometrics I suggest you copy this weather vane at the top of each sketch sheet and keep checking back to it.

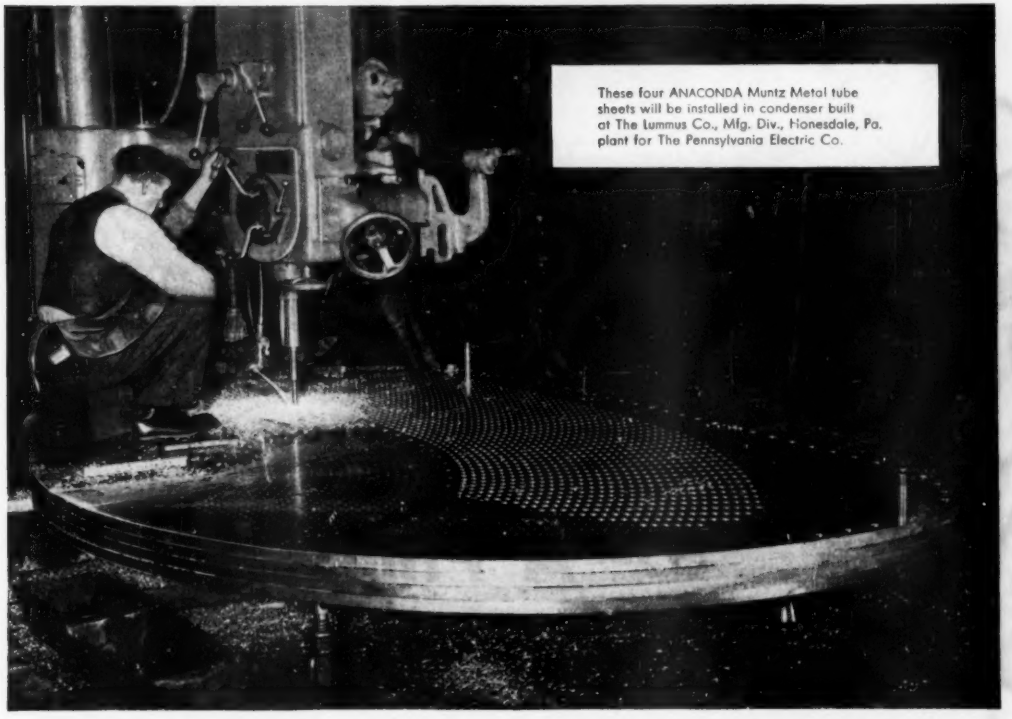
Draw a Cube. Drawing a cube in this system is a cinch, Fig. 3. It looks like a cornerview photo.

Fig. 4 shows two typical blocks drawn in isometric. Fig. 5 shows one block in its six possible prime positions.

If you have any isometric paper, repeat these sketches right now for practice. If not, you can do them with a T-square, a 30-deg triangle and any handy scale.

Just draw the lines in the object vertical or slanting 30 deg, and measure distances to the same scale in all three directions, north-south, east-west, vertical.

8 tons of ANACONDA Plates for 37,000 sq. ft. Condenser



These four ANACONDA Muntz Metal tube sheets will be installed in condenser built at The Lummus Co., Mfg. Div., Honesdale, Pa. plant for The Pennsylvania Electric Co.

The four ANACONDA Muntz Metal plates for tube sheets, here being drilled, will be used in a new low-headroom surface condenser at the Front St. Station of the Pennsylvania Electric Co. at Erie, Pa. This space-saving condenser, of special design, has 37,000 sq. ft. surface area and was engineered and built by The Lummus Company, Manufacturing Division.

ANACONDA Muntz Metal was selected as the most practical, economical tube sheet alloy for the particular service conditions at this Erie installation. Rolled at The American Brass Company's Detroit mill, each of these sheets weighs 4,000 lb. and measures 140″ x 92″ x 1¼″. They are typical of the plates which Anaconda mills have fabricated for so many of the largest power installations in the country.

Plates and tubes for condensers and heat exchangers are an Anaconda specialty. Our Technical Department's service and experience are freely available to you in the selection of the proper alloy for any heat exchanger use. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61116

for efficient heat transfer

ANACONDA® HEAT EXCHANGER TUBES

One day I caught him loosening packing glands just to get me in dutch

What! Marmaduke A Philosopher?

► Too bad every plant boss can't lift the lid off our 34-story skyscraper and peek inside. He'd learn plenty from his ringside seat, watching thousands of busy McGraw-Hill people, happily at work.

That's one reason our 25-Year Club has so many members. And that's why the Power staff gathered in our large, beautiful Board Room last week. Besides us Powerites, there was President Curtis McGraw, a handful of vice-presidents and other well-wishers.

The occasion? Well, our chief editor, Phil Swain, had just chalked up 30 years on this magazine. He didn't know it, but he was in for a surprise. Publisher Shelton Fisher told him there was an important Board meeting. When Phil barged in all set for headwork—WOW! There he was, before his many old associates, including his wife and two beautiful television-actress daughters. Phil was taken aback, but only for a second. With handshakes and congratulations all around, we toasted his first 30 years.

This sort of get-together is common on Power. Phil himself is always throwing a surprise luncheon or party for some of us. It might be a welcome, promotion, or a farewell luncheon, at some interesting neighborhood eating place. And Phil always picks up the check.

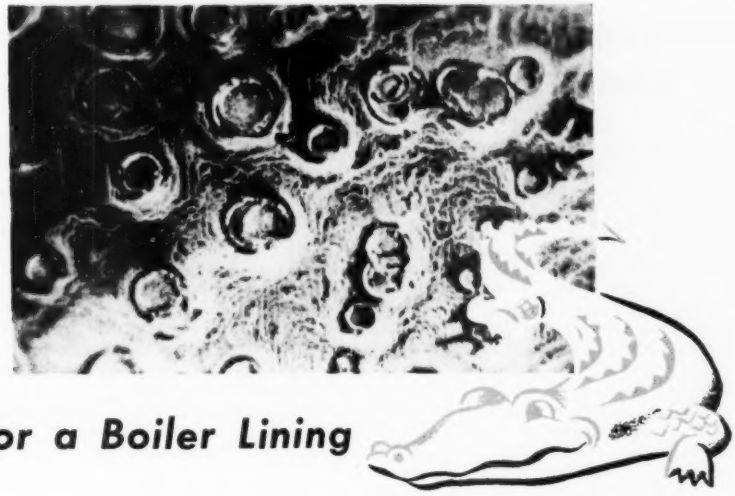
What does all this add up to? Well, it makes for better understanding and harmony. And Phil has a knack for making all of us feel like we're mighty important, regardless of our job. Of course we're not, but if you don't think that technique gets results, just try it on your gang. For one thing, he almost always blames himself for mistakes. Then he watches us break our necks trying to explain it's our fault.

But the high spot at this party came when Curtis McGraw presented Phil with an engraved wrist watch . . . "and for being such a popular editor," Curtis was saying, when HARRUMPH came a rumble from near the cocktail bar. "BILGEWATER ON POPULAR BOSSES," roared Marmaduke Surfaceblow, looking straight at Mr. McGraw. Then he added, "If a person can't get along with his shipmates, it's his own damn fault, and make no mistake about that."

All eyes popped at this unexpected interruption. And sure enough, our cantankerous hero, gray bowler, checked vest, and all six feet, four inches of him, was Johnnie on the spot.

(*Continued on page* 196)

Alligator Hide



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JENKINS PRACTICAL PIPING LAYOUTS

58

How to plan

PIPING CONNECTIONS FOR STEAM TURBINE DRIVEN CENTRIFUGAL REFRIGERATION COMPRESSOR

The centrifugal refrigeration compressor has wide application in air conditioning commercial, industrial, and institutional buildings where the air conditioning loads exceed 200 tons. Both steam turbine and electric motor drives for these compressors are widely used. However, provided sufficient high pressure steam is available, the steam turbine drive has some advantages such as simple, continuous speed control over a wide range, and direct coupling to the compressor. In recent years, district steam companies have promoted the use of steam turbine drives in order to balance, as much as possible, their steam loads over the summer and winter seasons.

The accompanying diagram shows typical piping connections for a steam turbine driven centrifugal compressor. This system is designed to operate with pressure steam at about 160 psi and condensing water at about 200 psi, since many of the cooling towers are located 300 to 400 feet above the engine rooms. Steam from the high pressure mains passes through an automatically controlled steam throttling valve which varies the turbine speed in accordance with the load on the air conditioning system. The control is based upon the temperature of the chilled water leaving the water chiller. A pneumatic controller, positioned by a temperature element in the chilled water discharge pipe, controls the air pressure on a diaphragm valve in the oil pressure system. This diaphragm valve controls the pressure on the steam throttling valve, changing the speed of the turbine in accordance with air conditioning load. In addition to this automatic speed control, manual speed control is provided for emergency use.

The exhaust steam from the turbine enters the steam condenser which maintains a very low back pressure (26″ to 28″ vacuum). Where district steam is used, it is generally uneconomical to return the condensate to the boilers, and therefore the condensate is merely discharged to the sewer after some of the heat of the condensate is used to preheat the domestic hot water for the building. Local codes usually prohibit the introduction of hot condensate to the sewer system and therefore cold water, thermostatically controlled, is mixed with the condensate whenever its discharge temperatures exceed the legal limit. By properly sizing the cooling tower, it is possible to use the same condensing water for both the refrigerant condenser and the steam condenser.

The Jenkins Valves listed are rated for the assumed high steam pressure of about 160 psi, and the condensing water pressure of about 200 psi. Jenkins Fig. 370 Bronze Gate is recommended for water and condensate shutoff service. It has a solid wedge for maximum resistance to pressure strains, especially in rapidly vibrating currents, and is ruggedly built for long service life. When open, the wedge entirely clears the pathway, affording full, unobstructed flow practically equal to the inside diameter of the pipe.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

A CHOICE OF OVER 500 VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from Jenkins Catalog. It's your best assurance of lowest cost in the long run. Despite their extra value, *you pay no more* for Jenkins Valves. Jenkins Bros., 100 Park Avenue, New York 17; Jenkins Bros., Ltd., Montreal. Sold through leading Industrial Distributors everywhere.

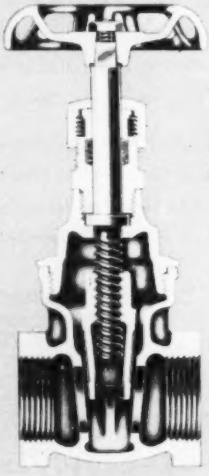


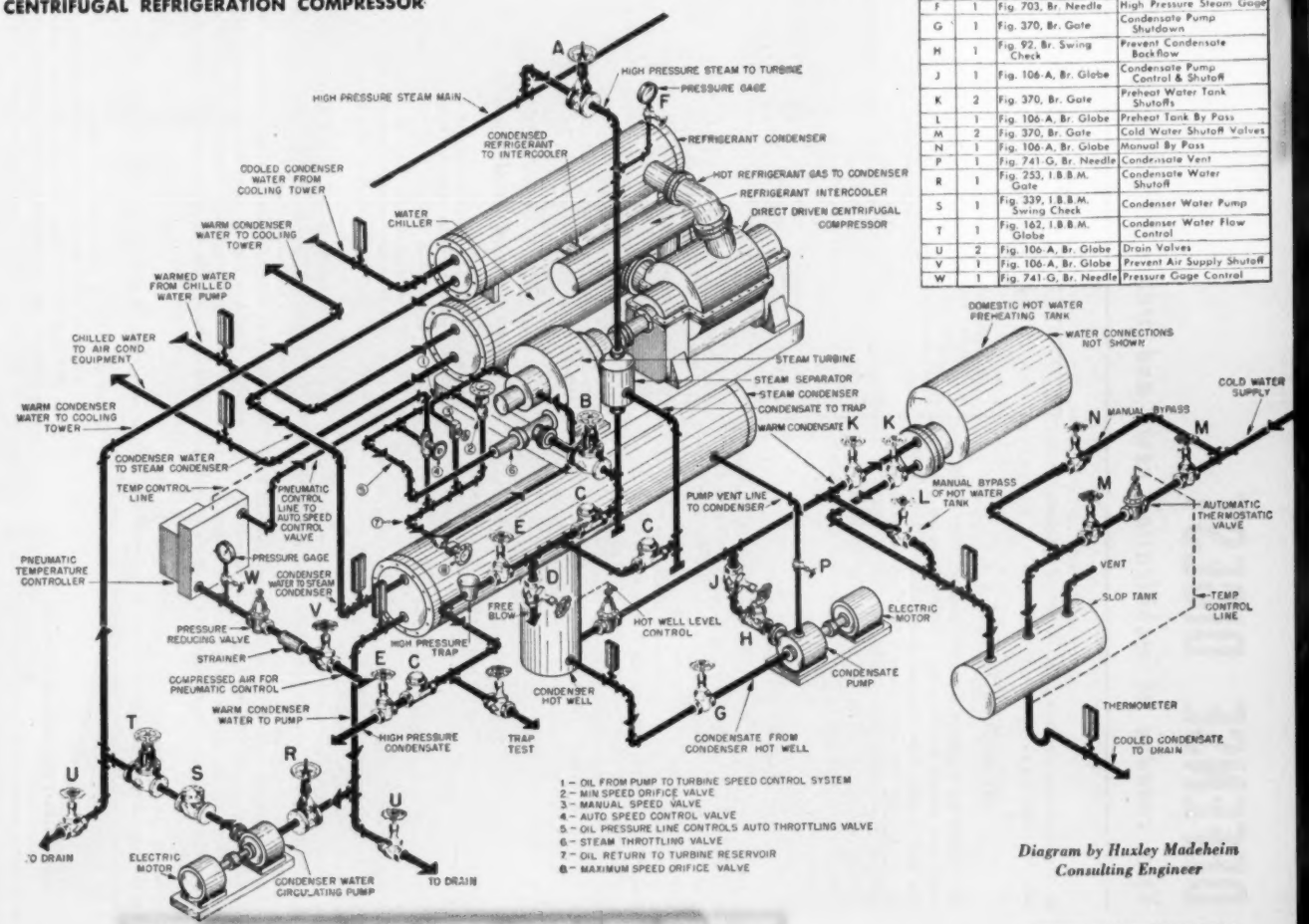
Fig. 370
BRONZE
GATE VALVE
Solid Wedge
Stationary Spindle

PIPING CONNECTIONS FOR STEAM TURBINE DRIVEN CENTRIFUGAL REFRIGERATION COMPOSITOR

VALVE RECOMMENDATIONS

For details of valves to suit varying conditions see Jenkins Catalog

Code	Quan.	Jenkins Valves	Service
A	1	Fig. 204, I.B.B.M. Gate	Main Steam Supply Shutoff
B	1	Fig. 923, I.B.B.M. Globe	Steam Supply to Turbine
C	3	Fig. 962, Br. Swing Check	Prevent Condensate Backflow
D	2	Fig. 970, Br. Globe	Free Blow and Trap Test
E	2	Fig. 280, Br. Gate	Trap Shutoff
F	1	Fig. 703, Br. Needle	High Pressure Steam Gage
G	1	Fig. 370, Br. Gate	Condensate Pump Shutdown
H	1	Fig. 92, Br. Swing Check	Prevent Condensate Backflow
J	1	Fig. 106-A, Br. Globe	Condensate Pump Control & Shutoff
K	2	Fig. 370, Br. Gate	Preheat Water Tank Shutoffs
L	1	Fig. 106-A, Br. Globe	Preheat Tank By Pass
M	2	Fig. 370, Br. Gate	Cold Water Shutoff Valves
N	1	Fig. 106-A, Br. Globe	Manual By Pass
P	1	Fig. 741-G, Br. Needle	Condensate Vent
R	1	Fig. 253, I.B.B.M. Gate	Condensate Water Shutoff
S	1	Fig. 339, I.B.B.M. Swing Check	Condenser Water Pump
T	1	Fig. 162, I.B.B.M. Globe	Condenser Water Flow Control
U	2	Fig. 106-A, Br. Globe	Drain Valves
V	1	Fig. 106-A, Br. Globe	Prevent Air Supply Shutoff
W	1	Fig. 741-G, Br. Needle	Pressure Gage Control



1 – OIL FROM PUMP TO TURBINE SPEED CONTROL SYSTEM
2 – MIN SPEED ORIFICE VALVE
3 – MANUAL SPEED VALVE
4 – AUTO SPEED CONTROL VALVE
5 – OIL PRESSURE LINE CONTROLS AUTO THROTTLING VALVE
6 – STEAM THROTTLING VALVE
7 – OIL RETURN TO TURBINE RESERVOIR
8 – MAXIMUM SPEED ORIFICE VALVE

Diagram by Huxley Madeheim
Consulting Engineer

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A Use the right type valve for the service

B Place valves correctly in the line

C Choose Jenkins for lifetime economy

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SINCE 1864
TRADE JENKINS MARK

DEFENSE DIGEST

Your roundup of mobilization news and trends affecting power men

► WHETHER THE IRANIAN CRISIS is settled satisfactorily or not, this winter's . . .

oil outlook is tight . . .

particularly for residuals from which come boiler fuels. It would take several months after a settlement to get production back in gear, turn rerouted tankers around, bring Iranian oil back into the world picture. So it's safer not to count on it for this winter's peak months.

What policy U.S. follows to help bolster world oil situation resulting from loss of Iranian output will pretty much determine . . .

just how tight . . .

our own situation gets. It's a matter of either sharing our surpluses with the world, or sharing in the over-all shortages. If we adopt a "share the surplus" policy, Petroleum Administration for Defense (PAD) will figure our normal needs against stocks and likely production levels, then say how much "fat" could be squeezed out to help the world picture. Estimates show we'd have a fair amount of gasoline to share, some distillate and kerosene, little or no residual.

If, instead of making available what we can spare, we pitch in to help where it's needed most, the going will be rougher because residuals are short in the world picture. Sharing would mean cutting our own supplies below probable needs for peak winter months. After first quarter of '52, things should ease off but boiler fuels will probably remain problem children. This . . .

dim long-pull prospect . . .

stems pretty much from heavy fuel's position as a byproduct or "residual." As long as more highly refined products give better returns, refiners will produce as little boiler fuel as technically possible, and modern refinery practice gives considerable leeway. Meanwhile, increased industrial and military activities boost demand.

Likely continued tightness in boiler-oil supplies will have to be accepted as a fact of life by power engineers. There is no visible move to encourage oil-to-coal conversions but government has directed that preference be given to coal in its installations.

Over on the natural gas side, "tight" is also the word, but the reasons are somewhat different. Inability of pipeline construction to keep pace with demand growth has led to PAD action to . . .

limit gas-use extension . . .

in 15 states and the District of Columbia. Order applies only to natural gas and doesn't take gas away from anyone now using it. In areas covered, no *new* large-volume consumers or central space-heating customers can be supplied. Important exception for large-volume users allows fully interruptible service to be extended unless gas is needed for underground storage. Sellers of gas in these areas may obtain exemption from the restrictions by proving that their supplies are ample to meet demands.

States now included in order are: Connecticut, Delaware, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Virginia, Wisconsin, and portions of Kentucky and West Virginia. In addition, comprehensive reports on usage and supply are required from sellers of gas in these states plus the following: Alabama, Florida, Georgia, Illinois, Indiana, Iowa, Minnesota, Missouri, Nebraska, North and South Carolina, South Dakota and Tennessee. Both lists may be amended.

Although transportation looms as a big question mark in that picture also, continued . . .

ample coal production . . .

is encouraging. Mine output is running ahead of 1950 and, more important, it could be expanded substantially if needed. But ability of railroads to carry coal to consuming centers can't be stepped up to match. Fact is, bituminous coal industry has been producing at about 90% of railroads' capacity to haul. And there seems no way of avoiding a severe car shortage this fall and winter.

A car-building program with allocated materials is under way but it's heavy on boxcars. Furthermore, rapid retirement of obsolete cars and withdrawals of old cars for repairs will offset much of expected gain from this source. In June, for example, 1362 new hoppers went into service, but 1533 were retired. Thus car shortages will be a problem for many months.

Even in normal times, transportation isn't geared to meet winter peak needs, so . . .

stockpiling is necessary . . .

in off seasons. It's more than ever necessary now. Here's a case where national needs closely parallel individual interests. Building up your coal stockpile whenever possible not only will ease the load on the railroads when the peak season is on, but it will also give you insurance against supply interruptions that might occur during winter months.

In addition, coal in stock now shapes up like a good investment. It's selling well below OPS ceiling prices and is likely to move up in price rather than down. No one would recommend buying coal now for speculative reasons but this situation does mean that you can stockpile for insurance purposes without fear of taking a loss as a result.

You can make another contribution toward keeping coal flowing. Turn cars around as quickly as possible, making the limited numbers do as much work as possible.

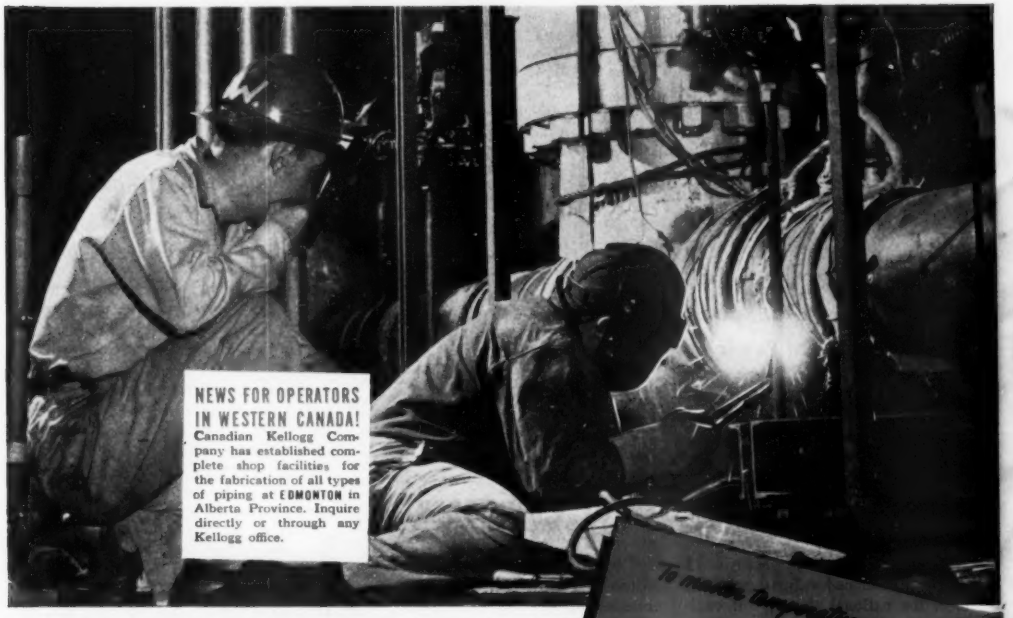
Help for you . . .

is the goal of this new department. From the thousands of orders, releases and reports issuing from mobilization agencies, we aim to cull those affecting power men. We'll tell you, briefly and plainly, what they *say*, and we'll dig into backgrounds to tell what they *mean*.

There'll be times when "spot" reports won't give the picture. Then we'll come up with boiled-down summaries like the one on pp 76, 77. Turn back to it for practical answers to your questions about the effect of CMP and other controls on purchases of power equipment. And read the paragraphs below for realistic slants on this winter's fuel-supply prospects.—*Ed.*

Note: behind this arc . . . some 80,000 hours!

. . . when this job-site welder strikes his first arc on your new power piping system, his welding rod has behind it some 80,000 hours of experience . . . specific experience in welding chrome-moly hi-pressure, hi-temperature piping for utility power installations. That's Kellogg's background for the highly specialized power installations of today. Add to this Kellogg's experience in heat treatment and non-destructive testing of thousands of these alloy welds. This total specialized experience is why more and more of the critical piping systems are specified "main steam and reheat piping by M. W. Kellogg".



NEWS FOR OPERATORS IN WESTERN CANADA!
Canadian Kellogg Company has established complete shop facilities for the fabrication of all types of piping at **EDMONTON** in Alberta Province. Inquire directly or through any Kellogg office.

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Special studies of unusual problems such as graphitization to assure long life and low maintenance.

Metallurgical research by recognized specialists who have made major contributions in this field.

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Exclusive Equipment for accurately analyzing stresses in piping and providing unique data for critical installations.

Complete facilities for the fabrication of steel products from simple forgings to specially cast bi-metallic devices.

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READER SERVICE SECTION

POWER NEWS 148
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PLANT EQUIPMENT NEWS 154
NEW FREE BULLETINS 163

Italian Power Program Receives Aid

Preliminary test of induced-draft fan by research engineers of Westinghouse Sturtevant Division, Boston, Mass. Destined for Societa Edison, Centrale Di Genova power station in Italy, this fan handles 1,240,000 lb of 300-F flue gas each day. To do this, the 5½-ft wheel driven by a 600-hp motor operates at 975 rpm

U.S. Plans Full Use of Engineers

► SECRETARY OF LABOR Maurice J Tobin has announced a 2-part program to meet the national shortage of engineering personnel. This shortage, he says, must be solved for the success of the defense production program, and industry and government must cooperate to supply the needs of both.

Part One of the voluntary manpower program suggests that employers should:

1. Make maximum use of engineers already employed. Also, figure out how many can be shifted to defense production; how many can be loaned to other plants.

2. Make better use of supporting engineering personnel by assigning to engineering assistants, aides and draftsmen more of the routine and detailed work done by professional engineers.

3. Determine the need for training required to prepare lesser skilled technicians for some of the tasks performed by engineers; organize and arrange for the training.

4. Stabilize the present engineering staff by identifying and correcting conditions that contribute to turnover and absenteeism.

5. List engineering openings with State Employment Service offices.

Under Part Two of the program, the following steps have already been taken:

1. Federal agencies are to make maximum use of engineering personnel.

2. Various organizations are cooperating with State Employment Services in exploring the possibilities of utilizing engineers on a full- or part-time loan.

3. The U.S. Office of Education has made plans to reactivate the Engineering, Science, Management War Training (ESMWT) Program of World War II for intensive, short-term college courses. This national defense training program is designed to prepare persons for specific jobs in defense plants. Engineering schools and colleges have been asked to make available their services and facilities to key defense industries, including part-time employment of faculty and students.

4. Local draft boards have been urged, in *Selective Service Operational Bulletin No. 42*, August 2, to give serious "consideration" to the deferment of engineers and draftsmen.

5. Ways to conserve engineering manpower in both the military and civilian personnel of the Department of Defense have been discussed.

6. The country's 1800 local employment offices are working with high-school and college officials to induce more high-school graduates to enter engineering schools.

7. The Engineers' Joint Council's Engineering Manpower Commission has embarked on a big program to encourage more high-school students to enter engineering colleges and schools, and to promote better use of engineers in industry and government. It has assembled facts to help bring about more realistic policies with respect to drafting and recalling engineers. Users of engineers are being informed of the critical shortage and how to conserve and make better use of engineers.

This blueprint of how to ease the shortage of engineers by making better use of those we have and training new ones was drawn up by the Department of Labor. They are being helped by the government's defense agencies and private organizations, including the Engineers' Joint Council's Engineering Manpower Commission, the AFL American Federation of Technical Engineers, the Council of State Governments, the National Association of County Officials and American Municipal Assn.

"It calls for concerted effort by Government, Industry, State, County, and Municipal officials to assure that all employees with engineering talents and experience are kept fully employed in activities which make maximum use of their skills, knowledges, and talents," Tobin said.

"United action by Government and Industry is essential if the acute engi-

(*Continued on page* 208)

FOR MORE NEWS . . .

. . . of the power field, see the items on pp 208-212. Also, the Coming Events for this issue appear on page 210. Appointments are on page 228.

Leesburg, Florida, plant of Minute Maid Corporation, showing outdoor installation of B&W Integral-Furnace Boiler.

pioneering with B&W Steam

As leaders and innovators in the high-vacuum method of concentrating citrus juices . . . as part of a thriving Florida industry, expecting a 35% growth over the next three years . . . Minute Maid Corporation appreciates the importance of economical first-cost, and operation of its equipment at peak-level efficiency.

For example, Minute Maid's modern Leesburg, Florida, plant is equipped with a new B&W Integral-Furnace Boiler, Type FF. Rated at 46,000 lb. per hr. of dependable, low-cost steam, this highly efficient unit is oil-fired by B&W steam-atomizing Y-jet burners. And the entire unit is installed out of doors, at considerable first-cost savings. Minute Maid reports performance in keeping with their highest expectations.

Remember—when planning your company's next expansion, modernization, or new plant—that the B&W Integral-Furnace Boiler family includes designs ranging from as little as 2,800 lb. of steam per hr. up to 350,000 lb. per hr., and larger. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

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TECHNICAL BRIEFS

Latest engineering developments for busy power men

9 digests for you on:
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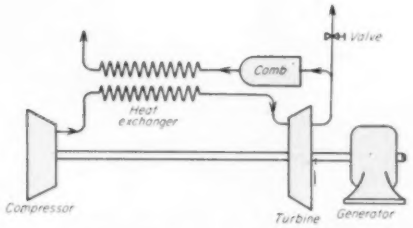
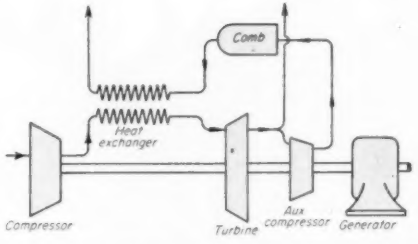
WATERWHEELS
CENTRALIZED CONTROL



1 To raise heat-exchanger temperature, all but exhaust needed for combustion process goes direct to exchanger



2 Scheme above gets around the need for a throttling valve and the loss it entails in handling exhaust-gas flow

Gas Turbines

Coal-Burning Gas Turbine. *By D L Mordell, McGill University.*

Gas Dynamics Laboratory at McGill University is designing and constructing a small experimental coal-burning gas turbine. The cycle on which this unit is to operate is the exhaust-heated cycle described by the author at an earlier meeting of the ASME. Since then modifications have been introduced to reduce the heat-transfer surface required and permit easier manufacture.

This paper outlines the thermodynamics of the revised cycle and presents general data on heat-exchanger sizes. For the prototype engine (design and construction financed by the Department of Mines and Technical Surveys) the starting point is a Rolls-Royce propeller-turbine engine. This engine has a 2-stage centrifugal compressor with a 2-stage axial turbine. The heat exchanger and furnace permit development of about 600 hp. Design features of the heat exchangers, which have to operate at temperatures greater than in conventional units, form a large part of the paper.

Advantage in using the exhaust-heated cycle is that the fuel burns behind the turbine, and its combustion products need traverse through the heat exchanger only. In this way the rotating parts have only air to handle so there is no chance of trouble in the turbine due to ash. Chief disadvantage is the large-size heat exchanger required if a good thermal efficiency is to be hoped for compared to other designs.

Many variations and schemes were considered possible to improve this major disadvantage. In Fig. 1 only as much of the turbine exhaust as is needed for combustion is used in the furnace. In this way, temperature difference in the exchanger itself is made much greater. But some form of throttle valve is needed, and rather than have this obvious loss, a scheme shown in Fig. 2 has been adopted. In it, the combustion air is handled by a blower much like an induced-draft fan. This supplies the pressure losses of the furnace and the exchanger. Calculations for a cycle of this type are given in the references. *ASME paper No. 51-SA-32.*

Heat-Transfer and Pressure-Drop Characteristics of Four Regenerative Heat-Exchanger Matrices. *By A Ambrosio, C D Coulbert, R P Litkis, D F O'Brien, F E Romig, University of California.*

The regenerative-type heat exchanger, in which the core structure or matrix acts as a reservoir of the heat for hot and cold fluids flowing alternately through the same flow passages, shows considerable promise as a heat exchanger in a regenerative-cycle gas turbine.

This paper covers an experimental investigation of four such regenerator matrices. One is made with a small cylindrical flow passage, one with flat plates separated by a small gap, and two with wire screens, each of a different mesh, placed normal to the flow. They are examined not by the usual steady-state method, but by a transient method employing a single-flow technique.

This technique closely approximates conditions in a regenerative heat exchanger. It is based on an analytical treatment of such a system by T E W Schumann. Operation is as follows: Hot air heats the matrix to a uniform temperature. Then this air is shut off and cold air is sent immediately through the matrix, with the temperature-time history of the air leaving the matrix being closely recorded. The thermal performance is then evaluated by means of Schumann's solution.

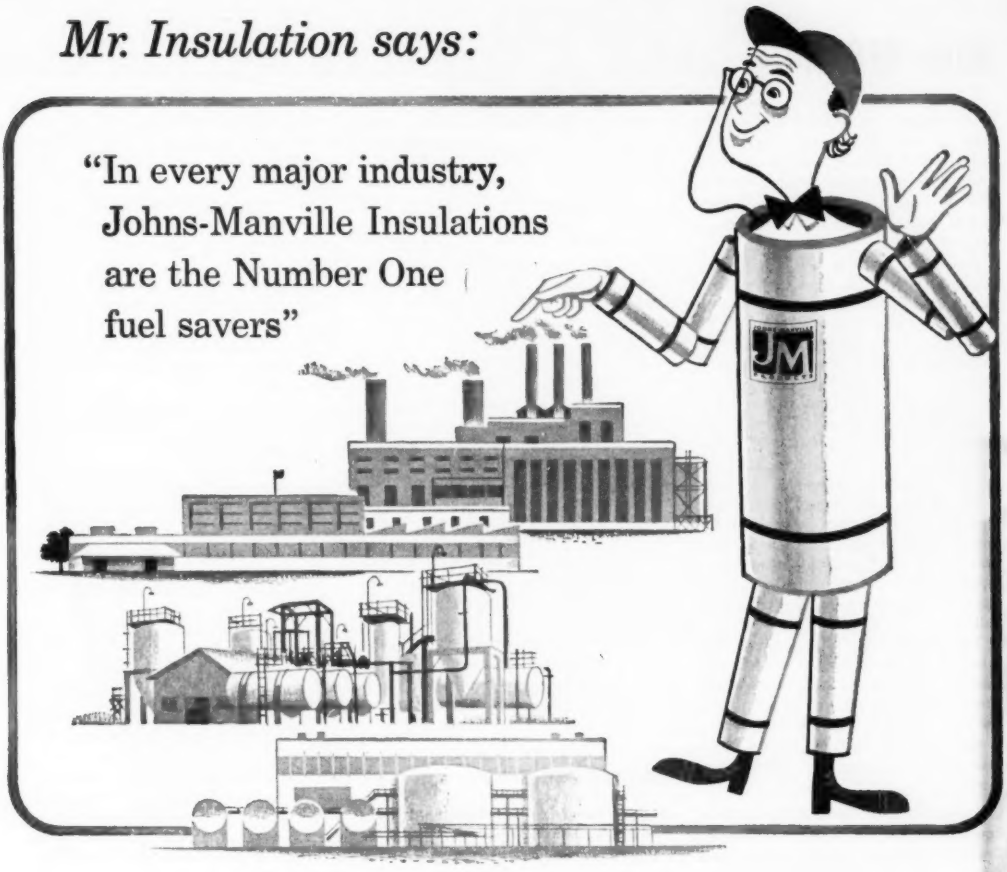
For flat plates and cylindrical tube matrices, flow was laminar, because of the small hydraulic diameter of flow passages and of velocity limitations imposed by allowable pressure drop. For predictions of pressure drop, well-known theoretical treatments will do, but for heat-transfer rates the usual predictions, based on constant and uniform wall temperature, had to be modified to conform to the more complicated conditions encountered in the generator matrix. For heat transfer from matrices, made of layers of screen, few previous data are known. The paper features diagrams. *ASME paper No. 51-SA-34.*

Directions for ordering papers are given on page 152

Electrical Controls

Application and Standardization of High-Rupturing-Capacity Current-Limiting Fuses. *By J W Gibson, General Electric Co, Ltd, Birmingham, England.*

Mr. Insulation says:



IN PLANTS with stacks or stills, tanks or towers, the story is the same—"Insulation by Johns-Manville" means the maximum return on your investment. There are two good reasons for this:

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Johns-Manville *first in* **INSULATIONS**

More TECHNICAL BRIEFS

Begins on page 150

Fault values on low-voltage systems often greatly exceed the interrupting rating (10,000 amp) of the cartridge fuses now recognized by the National Electric Code in the USA and the Canadian Electrical Code in Canada as properly safe.

Fuses are available that have interrupting ratings in line with today's needs, and, in addition, offer many technical advantages. These advantages are obtained with a product having considerably smaller dimensions than those of "code" fuses of the same voltage and plant rating. Design and performance of the modern high-rupturing-capacity hrc fuse is referred to in two American and two British papers given in the author's references.

The author then describes the construction, performance and principles governing fuse applications. It is stated that while the discussion deals principally with low-voltage fuses, the data apply in general equally well to higher voltages.

The paper closes with, first, a summary of the advantages of hrc low-voltage fuses compared with the "code" fuses and carries through to a comparison of these fuses with circuit breakers. It also discusses the trend toward standardization now under way. *AIEE paper. No number.*

Coordination of Control and Drive Equipment on Dc Electric Traveling Crane Bridges. *By D C McGrady, Steel Co of Canada, Hamilton, Ont.* One phase of traveling-crane maintenance arises from the fact that crane builders have not given sufficient thought, in the opinion of the author, to the selection of gear ratios and motor sizes for specific applications. Further, control manufacturers have built all bridge controls to the same general specifications without, again, any consideration of the specific crane service involved.

The latest AISE specifications for cranes cover the selection of hoist and trolley drives in a most satisfactory manner. There is, however, one major drawback in that the entire selection for bridge drives is based on the top or balancing speed of the crane. The author feels that this particular speed can vary widely from one month to another, depending on wheel, rail, and temperature conditions. In fact, he states that friction alone has been known to vary from 9 to 17 lb per ton from one crane to another with roller bearings. Yet each manufacturer uses his own estimate of what the value should be with wide variation in drive selection.

A new approach to the problem cited by the author appeared in a paper that Wise & Bramley presented in England. They suggested that bridge performance be judged and specified by two criteria: (1) Speed after ten seconds from rest. (2) Time to travel 8 ft from rest. Their paper is said to include a large number of tests to substantiate these two quantities as a basis for classifying cranes from an operating standpoint.

The author has run a number of tests to prove for his own satisfaction that the first requirement is met by a given combination of motor rating, gear ratio, and control regardless of friction value for all practical purposes over a range from 10 to 25 lb per ton. The reason, he feels, is that with a series-wound motor the speed after ten seconds is not overly sensitive to friction value, whereas the balancing or top speed is. Yet this speed gives an excellent measure of the practical crane operation.

Second requirement, time to travel 8 ft, is an accurate measure of the initial acceleration or "snappiness" of the crane. *AIEE paper. No number.*

Waterwheels

Modern Trends in the Design of Vertical Waterwheel Generators. *By C M Laffoon, E C Whitney and R A Baudry, Westinghouse Electric Corp.*

Waterwheel generators have been improved in reliability, compactness and ease of maintenance. The last ten years have shown a continuation of the popularity of the umbrella-type unit and enclosed machine. Outdoor and underground stations are becoming more popular.

An indication of the trend toward compactness and easy maintenance is the preference for two general types of bearing arrangement.

1. Construction is arranged with a thrust and guide bearing above the rotor and various possible combinations of guide bearings below the rotor. This type applies to high-speed, high-head units where the thrust is low, as with the multiple jet impulse, and some francis-type turbines that can be applied to any speed and size unit.

2. Second and most successful arrangement for providing minimum weight and size is the umbrella-type design. Its construction is the simplest for number of guide bearings, lubrication, and oil coolants. Since the rotor can be removed without disturbing the bearing and alignment of the shaft, it adapts itself to the lowest station height and simplest maintenance operation. Shaft and bearings can be installed and the shaft aligned while rotor and stator are assembled separately, thus reducing to the minimum erection time and expense. The usual reduction in powerhouse height permitted by this umbrella unit is between 4 and 18 ft when compared to the equivalent 2-bearing machine.

An upper guide bearing is sometimes applied to the umbrella-type unit in which the machine proportions or bearing design, or both, do not give enough machine rotor stability. Occasionally customers have specified upper bearings from a preference standpoint. If the thrust bearing is not the rigidly supported shoe type, and hence does not provide stability for the rotor, the upper guide bearing is necessary.

The authors discuss other major design parts and the changes in their construction features in much the same detail as the bearing arrangement described above. *AIEE paper No. 51-216.*

Centralized Control

Remote Operation Through Centralized Control Rooms. *By D T Frankenberg, American Gas & Electric Service Corp.*

When the boiler, turbine and auxiliary equipment of the power plant had proven highly reliable, pressure began to mount toward a centralized control room. A study of forced outages indi-

(*Continued on page* 190)

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from one of the following sources unless otherwise stated. Order complete paper from source, not from POWER.

American Society of Mechanical Engineers, semiannual meeting, Royal York Hotel, Toronto, Ont. June 11-14, 1951. Identified by initials ASME and obtainable through ASME, 29 W 39St, New York 18, N. Y.

American Institute of Electrical Engineers, summer general meeting, Royal York Hotel, Toronto, Ont. June 25-29, 1951, and the Great Lakes district meeting, Madison, Wis., May 17-19, 1951. Identified by initials AIEE and obtainable through AIEE, 29 W 39th St, New York 18, N. Y.

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HELPFUL-INFORMATIVE IT OUTLINES THEORIES AND BASIC PRINCIPLES OF CENTRIFUGAL DUST RECOVERY!

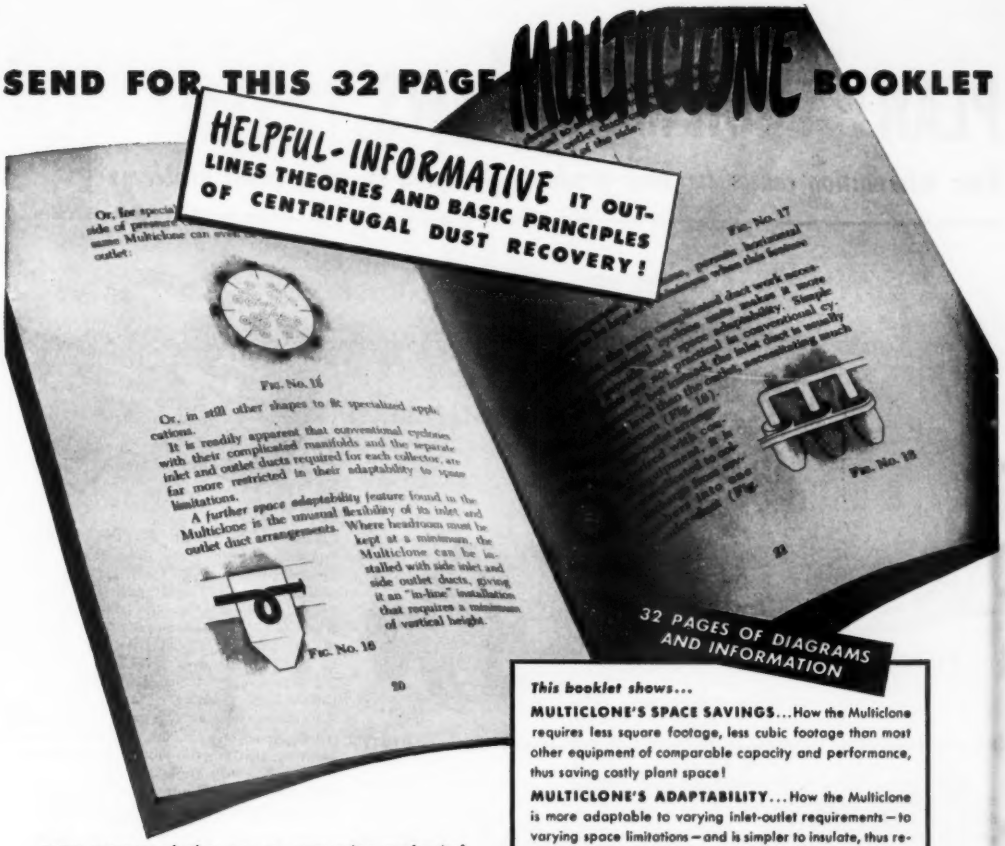
Fig. No. 16
Or, in still other shapes to fit specialized applications.
It is readily apparent that conventional cyclones with their complicated manifolds and the separate inlet and outlet ducts required for each collector, are far more restricted in their adaptability to space limitations.
A further space adaptability feature found in the Multiclone is the unusual flexibility of its inlet and outlet duct arrangements. Where headroom must be kept at a minimum, the Multiclone can be installed with side inlet and side outlet ducts, giving it an "in-line" installation that requires a minimum of vertical height.
Fig. No. 16
20
Fig. No. 17
Fig. No. 18
32 PAGES OF DIAGRAMS AND INFORMATION

NO MATTER whether you are now using mechanical dust recovery equipment or are planning the installation of such equipment at some future date, here is a booklet that is full of helpful and valuable information on centrifugal dust recovery. It not only explains the basic methods and principles involved, but also shows the important differences between small and large diameter separating tubes, shows how to simplify your duct work and reduce installation costs, and outlines many other important factors to be considered in selecting mechanical dust recovery equipment.

In addition, this informative booklet illustrates and explains how MULTICLONE'S unique *vane* design is fundamentally different...how it makes possible greater compactness, simpler installation, high recovery of the small particles as well as the medium and coarser ones, and many other facts on MULTICLONE advanced design.

A limited supply of these booklets is available for free distribution to those interested in mechanical recovery equipment and methods. Write for your copy today.

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MULTICLONE'S SPACE SAVINGS...How the Multiclone requires less square footage, less cubic footage than most other equipment of comparable capacity and performance, thus saving costly plant space!

MULTICLONE'S ADAPTABILITY...How the Multiclone is more adaptable to varying inlet-outlet requirements—to varying space limitations—and is simpler to insulate, thus reducing installation costs!

MULTICLONE'S EFFICIENCY...How Multiclone's multiple *small diameter* tubes, made possible by its exclusive *vane* design, give higher centrifugal forces and more complete cleansing of *all* suspended particles—even small ones of 10 microns and less!

MULTICLONE'S LOW MAINTENANCE...How the Multiclone has no high speed moving parts to repair or replace, no pads or filters to clean or renew, nothing to choke gas flow or increase draft losses as suspended materials are recovered. Multiclone draft losses remain uniformly low—recovery efficiencies uniformly high—at all times!

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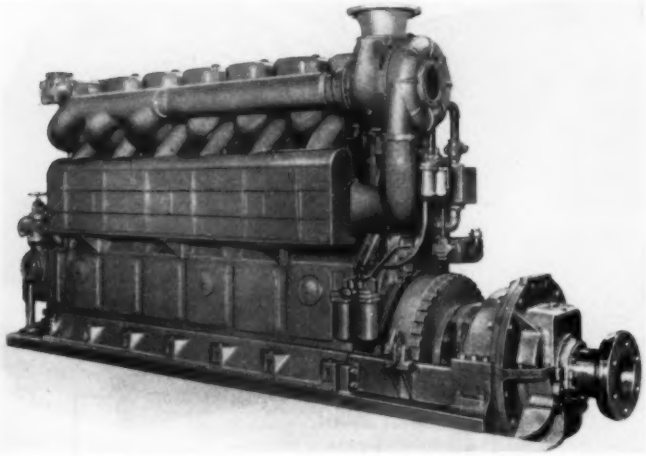


ENGINE FEATURES INTERNALLY COOLED SUPERCHARGING P1077

Supairthermal 4-cycle design, available from 425 to 3200 hp and as a straight-diesel, dual-fuel or spark-ignited gas engine, is able, maker claims, to deliver one-third more hp from given size without increase in heat rejected to cooling water or in internal surface temperatures, pressures.

Increase in output comes from lowering temperature of air in cylinder at time fuel is injected. This increases *weight* of air in which to burn fuel. This is a major factor in determining specific output.

Conventional supercharging puts intake air under pressure, hence increases amount charged to cylinder. But blower raises air temperature and specific volume. Hence fuel gain, *in terms of weight of air charged*, isn't realized. Use of an intercooler to remove some of the heat of compression before air goes into cylinder increases supercharging effectiveness but is limited by temperature of water available for cooling. *Supairthermal* engine introduces further cooling by expanding cylinder air.

Exhaust-driven turbocharger delivers air to intercooler at 15 psi (at rated full load) and at about 160 F. Intercooler lowers air temperature to within 10 F of cooling-water temperature. With 90-F water, air enters engine cylinders at 15 psi, 100 F.

In the *Miller* system of supercharging used in the *Supairthermal* engines, point at which intake valve closes is automatically controlled by intake-manifold pressure. At full rated load, for example, valve closes 45 deg before end of stroke. Air in cylinder then expands from 15 to 6 psi as piston continues to end of intake stroke. Expansion drops temperature from 100 to 50 F.

As manifold pressure decreases at part loads, intake valve closes later so air pressure at beginning of compression stroke remains 6 psi. At light loads where intake manifold pressure is 6 psi or less, closing of intake valve is fully retarded and pressure and temperature at beginning of compression is same as in manifold after intercooler.

Nordberg Mfg Co, Milwaukee 7, Wis.

THREAD RESTORER P1027

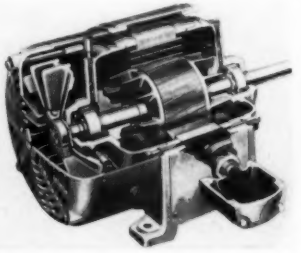
Latest thread-restorer set, TR7, of the manufacturer has eight sizes of restorers, ranging from a bolt diameter of ¼ in. with 28 threads per inch to a ¾-in. bolt with 16 threads per inch.

Bonney Forge & Tool Works, 716 Meadow, Allentown, Pa.

For more data on these items, use post cards, p163. Identify request with P and number.

And Next Month . . .

Line of multistage, mechanical-drive turbines from 200 to 5000 hp. Suitable for wide range of industrial applications along with the job of power generation. Typical application is driving pumps, compressors, fans, blowers, etc. Four general types are available, each varying somewhat in speed range, accuracy of control, etc.



EXPLOSION-PROOF MOTOR P1037

Available from 3- to 75-hp, Types SE and SES carry the Underwriters' label in Class I, Group D (highly flammable gases and volatile liquids) and in Class II, Groups F and G (combustible dusts). Other types, SD and SS, without label, are also available for nonexplosion-proof services.

Features include: Sealed terminal, elongated spark-arresting bearing sleeves, streamlined housing, hi-draft ventilation, removable cover, split hub fan, normalized castings, and asbestos-protected windings. Bulletin No. 1629 available.

U.S. Electrical Motors, Inc, 200 East Slauson Ave, Los Angeles, 54 Calif.

TEMPERATURE REGULATOR P1026

Expansion, stem-type regulator, the *Accritem*, maintains liquids or air at any desired temperature by controlling settings of pneumatic or water-operated diaphragm valves or dampers. It has a calibrated dial temperature adjustment in two ranges 50-250 F and 150-350 F, and operates under compressed air or water at 15 psig.

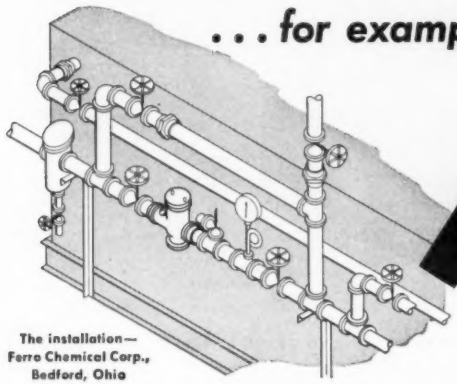
Powers Regulator Co, 3501 Oakton St, Skokie, Ill.

AIR VIBRATOR P1008

Ideally suited for applications where air vibration creates a noise nuisance, the new noiseless air vibrator, *Type AC*, has a hard, chrome-plated piston that develops the vibrating action. The momentum set up by the piston is cushioned by pockets of air

for outstanding service

on Steam to Drying Ovens . . . for example



The installation—
Ferro Chemical Corp.,
Bedford, Ohio

PROBLEM: To maintain automatically, within close limits, uniform reduced steam pressure from supply line to battery of two drying ovens controlled by individual thermostatic valves.

WORKING CONDITIONS: Initial steam pressure of 70 psi to be reduced to 13 psi, and maintained without significant fluctuation whether one, both, or neither of the ovens is being operated.

SOLUTION TO PROBLEM: One No. 960 Crane Brass Pressure Regulator, properly selected for capacity required, and with adequate condensate drainage provided.

RESULT: For more than 5 years, without interruption and with no more than routine maintenance, the Crane No. 960 Regulator has given complete satisfaction. Operating like new, and since all wearing parts are renewable, it will virtually never wear out. User remarks on unusual simplicity of adjustment.

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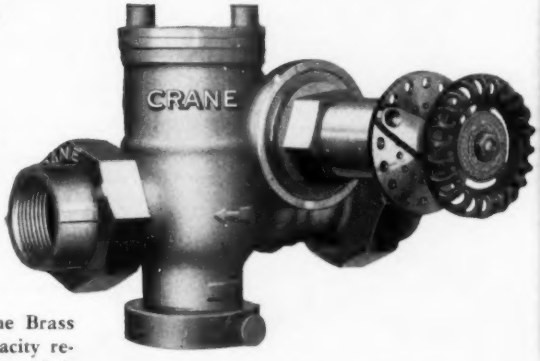

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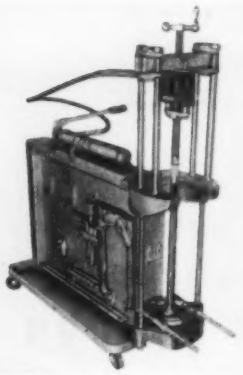
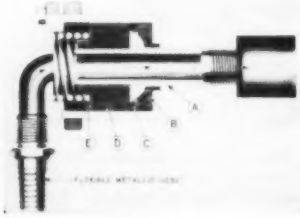
Begins on page 154

at the end of the vibrator assembly. Both vibration speed and intensity can be varied at will. Device weighs 2 lb, 11 oz, is 6½ in. long by 1½ wide.
Cleveland Vibrator Co, 2820 Clinton Ave, Cleveland, O.



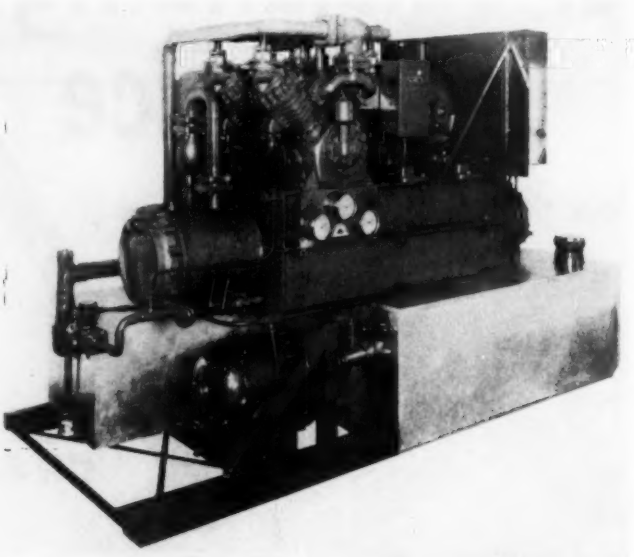
PORTABLE TOOL P1025

Easily moved, sturdy, welded-steel constructed device carries hydraulic pulling system for bearings, pulleys. The OTC *Hydra-Tote* stands 32 in. high, 36½ long, 16 wide at the base and 4 in. at the top. This unit and special Power-Twin, a 17½-ton hydraulic press, can be moved to any machine in your plant for bearing removal or other similar pulling jobs.
Owatonna Tool Co, 378 Cedar St, Owatonna, Minn.



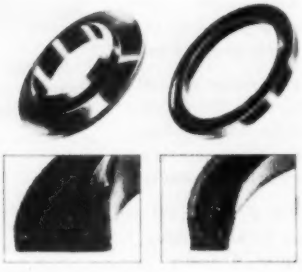
SELF-SUPPORTING ROTARY PRESSURE JOINT P1018

Joints are suitable wherever heating or cooling agents must be admitted to rotating rolls, as in paper-making, textile and rubber mills. Type S joint was developed specifically for jobs where misalignment is met. It is suitable for pressures up to 250 psi. Joint is packless, self-lubricating, self-adjusting and self-supporting. Either through-flow or siphon-pipe service joints are available in sizes from ¾ to 3 in.
Johnson Corp, Three Rivers, Mich.



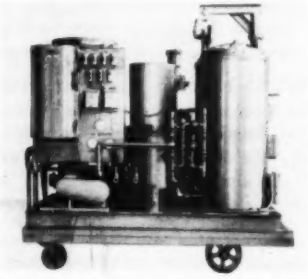
AUTOMATIC WATER COOLING UNIT AND BRINE CHILLER P1013

Industrial water or brine cooling units (3 to 150 tons) is entirely self-contained and is ready for operation when connected to water and power lines. One pushbutton controls a continuous, automatic supply of recirculated chilled water or brine at temperature and volume needed. Units are built in eight sizes with refrigerating capacities ranging from 3 to 150 tons. They include a high-head, high-volume water-circulating pump, storage tank and complete auxiliary equipment assembled on permanent steel skids that eliminate need of foundation or bolting down. Unit operates on either gravity or pressure water return without an additional pump and automatically adjusts to variable load and flow. Temperature range adjustable.
Mayer Refrigerating Engrs, Inc, Rutherford, N. J.



MOLDED PACKING P1076

Compression molded from special fabric and neoprene compound, these packings have high wear qualities and resistance to many hydraulic fluids. Precision made, they are suitable for hydraulic and pneumatic cylinders, pumps, valves, etc, as static seals or in transverse-action applications.
Periflex, Inc, Hazel Park, Mich.



OIL-PURIFYING UNIT P1045

Mobile purifying unit for insulating oils removes all acidity, moisture and sludge—restores interfacial tension and dielectric strength of oil, all in one operation. Typical application is transformer and circuit breaker insulating oils.

Purivac consists of two purifiers, heat exchanger, dehydrating and degasifying unit,

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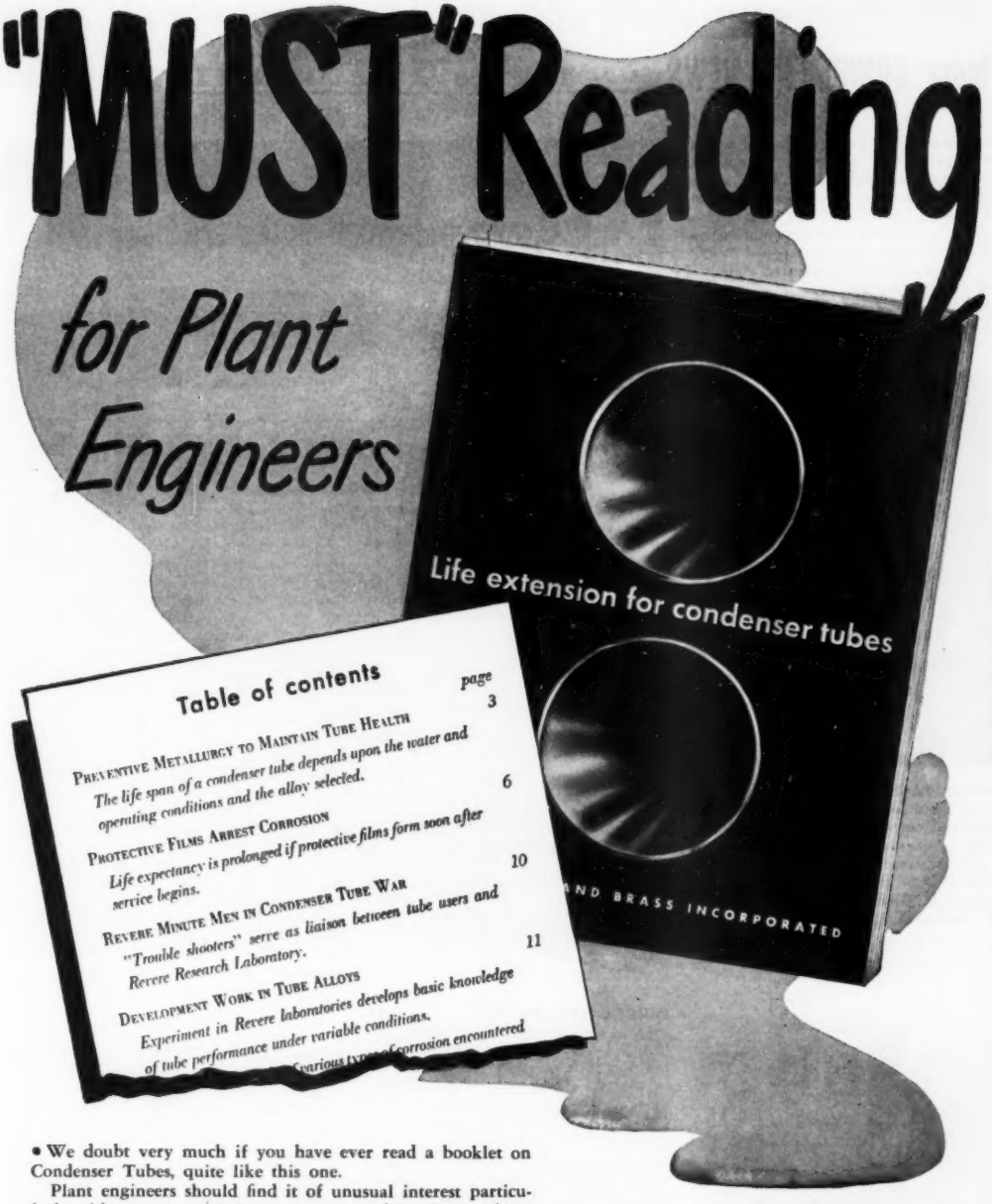
Life extension for condenser tubes
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PREVENTIVE METALLURGY TO MAINTAIN TUBE HEALTH
The life span of a condenser tube depends upon the water and operating conditions and the alloy selected. 3
PROTECTIVE FILMS ARREST CORROSION
Life expectancy is prolonged if protective films form soon after service begins. 6
REVERE MINUTE MEN IN CONDENSER TUBE WAR
"Trouble shooters" serve as liaison between tube users and Revere Research Laboratory. 10
DEVELOPMENT WORK IN TUBE ALLOYS
Experiment in Revere laboratories develops basic knowledge of tube performance under variable conditions. 11
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Plant engineers should find it of unusual interest particularly with present restrictions on copper and its alloys making it more important than ever that every last ounce of use be squeezed out of the condenser tubes in their plants.

This 28-page booklet includes data on various copper alloys, photos of cut-away tube sections showing various types of corrosion encountered in condenser tube service and photomicrographs showing the grain structure of different kinds of metals under varying operating conditions.

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electrical control panel, pumps and motors. Dual-purification units may be operated separately, in parallel or in series as desired. Purification, dehydration and degasification of insulating oil can be performed either in the field or at a central station. In the field they can be connected directly to the transformer and operated while it is in or out of service.

Honan-Crane Corp, 200 Superior Ave, Lebanon, Ind.

HAND TACHOMETER P1042

Dr Horn centrifugal hand tachometer boasts six ranges covering from 25 to 30,000 rpm in one instrument. It is protected against damage from overspeeding. Bulletin 35-65-24 available.

James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa.

"WHEN YOU GETTING YOUR NEW GLASSES, JIMSON?—YOU'RE READING THAT CRACK IN THE WALL"AGAIN!"

COURTESY WHEELCO INSTRUMENTS COMPANY

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DRY-TYPE TRANSFORMER WITH CLASS H INSULATION P1031

Available as ventilated or sealed-in-nitrogen unit for station auxiliary, unit substation and network service. Class H ventilated transformers can be had in ratings to 3000 kva and voltages to 15 kv. Class H sealed-in-nitrogen units in sizes to 2000 kva, 15 kv and below.

Class H transformers are fire-resistant, explosion-resistant, moisture-repellent and heat-stable. Class H insulation as used in transformers consists of inorganic materials like glass, porcelain and asbestos bonded or impregnated by the silicone resins or rubbers, or by the fluorocarbon resins.

Exposed to air, Class H insulation has about 100 C temperature advantage over Class B insulation. In their various forms, combined with inorganic materials, silicones permit operating temperatures higher than those for comparable organic materials.

Pennsylvania Transformer Co, PO Box 330, Cannonsburg, Pa.

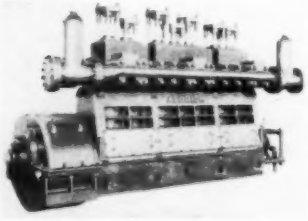
DRY-TYPE TRANSFORMER WITH CLASS B INSULATION P1035

For single-phase 60-cycle operation, the new design provides smaller transformers at an average weight reduction of 30% throughout the line. Some models actually weigh less than half the old units.

These size and weight advantages are obtained through the use of improved core steels and increased amounts of inorganic insulating materials. Insulation withstands higher temperatures in the copper windings—80 C rise over a 40 C ambient. *Corisil* core (a grain-oriented, cold-rolled silicon steel) provides comparable losses at higher flux densities. Net result is less copper and steel per kva of output.

In all, the line ultimately will consist of about 50 models in ratings of 3 kva and upwards. It will include transformers equipped with two 5% taps below rated primary voltage, transformers for 32-volt applications, transformers for boosting and bucking applications, transformers for general light and power service, and autotransformers for general light and power service.

General Electric Co, Schenectady 5, N. Y.



DIRECT-FLOW PUMPS P1011

Six-inch-stroke direct-flow pumps are built with 3, 5, 7 and 9 plungers, and range in power from 300 to 900 hp. Among their applications are chemical handling, heavy forging-press service, steel-mill descaling, water-injection in oil fields and lean oil pumping.

Pumps operate at 300-rpm crankshaft speed, suitable for direct drive from an engine or engine-type synchronous motor. They have a direct-flow fluid end with cylinders and plungers in the top of the pump in what is known as an inverted design.

All wearing parts are interchangeable among 3, 5, 7 and 9 plunger units. Fluid end is sectionalized to simplify maintenance. Reduced space between valves gives high volumetric efficiency, and plunger size changes can be readily made for changes in pressure and capacity.

Aldrich Pump Co, Allentown, Pa.

TURBINE BUCKETS P1023

Standardized turbine buckets for high- and low-speed applications have been developed. The turbine-bucket root is designed for centrifugal loading to take place very close to the center of effort of the root so as to avoid tilting the bucket. With a circumferential wheel slot root, greater efficiency is said to result because of the pitch and elimination of gaps in bucket spacing. The integral shrouds are machined on the periphery after assembly.

Schellens-True Corp, Main St, Ivoryton, Conn.

COMPRESSED AIR TRAP P1028

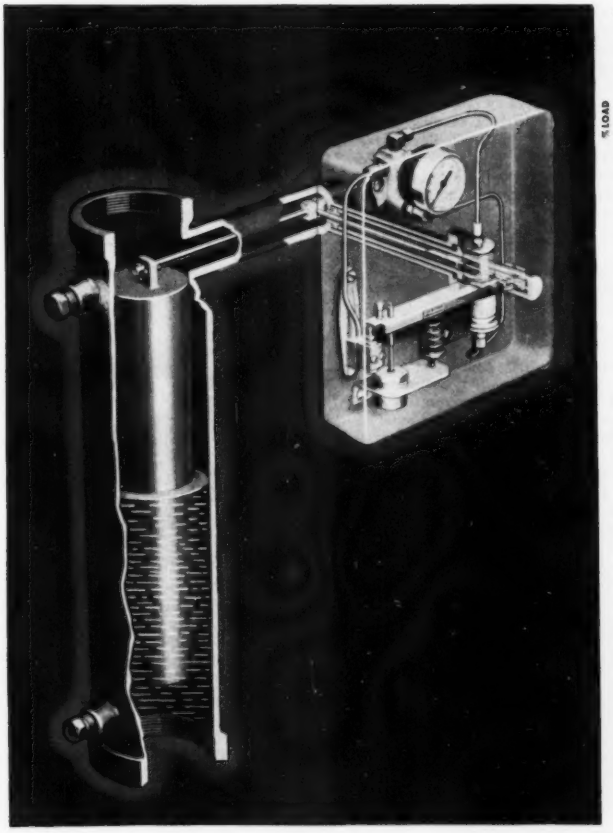
Water, oil, sludge and other foreign materials can be removed in a single unit, the *Condensifilter*, consisting of a dehydrating device, a mechanical filter, a self-purging trap. Unit measures 15 in. high by 9 in. dia. It has a capacity of 30 cfm at 100 psi and is recommended for purifying and dehydrating air used in combustion and process control.

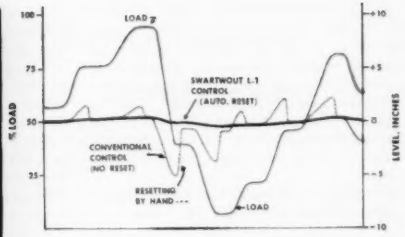
Hankison Corp, 365 Renton Bldg, 1501 Beaver Ave, Pittsburgh 33, Pa.

LIQUID WATER REPELLENT P1016

H2-O-NO is a clear silicone-base liquid water repellent for exterior masonry surfaces. One application of the liquid effectively keeps water out of masonry up to five years. It is also reputed to repel soot and dirt, minimize efflorescence and reduce

Hold liquid levels within ±1/2 inch automatically with Swartwout L1 Displacement Type Controls



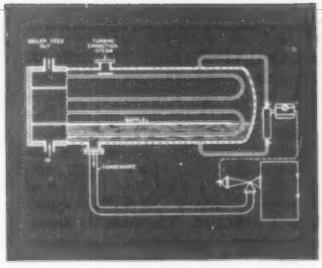


1 Precise control of liquid level from no load to full load without manual readjustment is provided by Swartwout L1 Controls. Setback and reset features compensate for quick-changing loads or long process lags . . . eliminate any tendency to cycle or hunt, yet permit control within narrow range of ±1/2 inch. Graph *(above)* shows precision of L1 compared with conventional control on applications where level must be maintained within ±1/2 inch.

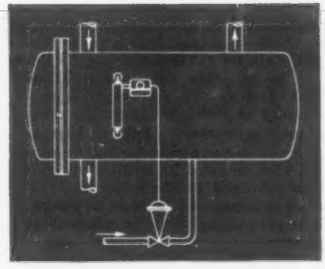
Operating on balance of forces principle, there is little actual movement of parts. Torque tube design eliminates stuffing boxes . . . gives continuous leakproof operation. Since changes in liquid level vary effective weight of displacement type float, L1 Controls can also be used for throttling over full length of float, available in lengths from 15 to 120 inches. A-3896

Swartwout

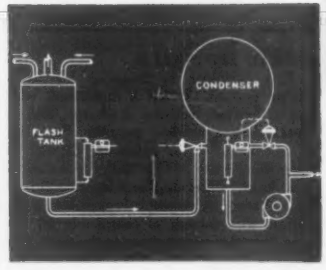
POWER PLANT EQUIPMENT



2 Horizontal Subcooled Heaters–L1 Control holds level to ±1/2 inch, never lets condensate cover tubes that should be exposed to steam . . . never exposes tubes that should be covered with condensate.



3 Evaporators–Swartwout L1 Displacement Type Control holds level within ±1/2 inch . . . prevents carryover of solids and contamination of boiler feed water. Increased plant efficiency results.



4 Flash Tanks–Level maintained, in some installations, by L1 Control draining to condenser. Hot well level precisely maintained by controlling condensate recirculation from pump discharge.

SEND FOR BULLETINS S-15-A, S-208-A • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

More EQUIPMENT NEWS

Begins on page 154

spalling. Liquid is said to enter 1/16 to ¾ in. into mortar on application, forming a silicone lining. It doesn't plug pores or prevent transpiration of air. Repellent is recommended for concrete, brick, stucco, concrete blocks, mortar joints, asbestos shingles, unglazed tile, etc. Coverage ranges from 100 to 300 sq ft per gal. Solution available in 1- and 5-gal cans and 55-gal drums.

The Chem Industrial Co, 1114 Hippodrome Bldg, Cleveland 14, Ohio.

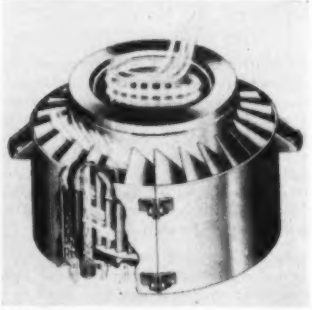
FUEL CUTOFF **P1004**

Heavier, float-operated, signal switch device operates on pressures from vacuum to 450 psi. The new device, *Levalarm EA-10*, has been redeveloped from a signal switch. It can serve as a fuel cutoff as well as a means of operating warning signals like bells, sirens or lights when liquid levels in small boilers or various special tanks reach predetermined low or high points.

Reliance Gauge Column Co, 5902 Carnegie Ave, Cleveland 3, Ohio.

Now Take Another Minute To Check These . . .

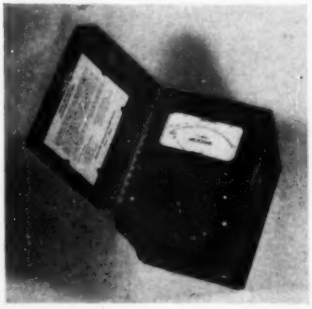
Lighting Fixture easy to clean ... p 168
Leather V-Belt for long life ... p 170
Reel for heavy electric cables ... p 172
Concrete Cutter slices to 10 fpm ... p 174
Stoker for easy hopper filling ... p 176
Battery Charger sets on shelf ... p 178



SELF-CONTAINED AIR CONDITIONER **P1017**

Self-contained air conditioner is designed to save floor space, cut service and maintenance to a minimum and operate quietly. Vibration-muffling spring mounting of compressor and full glass fiber acoustic and thermal insulation of casing contribute to quiet operation. Two-knob control panel on front permits easy setting of desired temperature, operation of unit for heating or cooling or use of fan alone. Suitable for stores, offices, apartments, industrial plants, etc, these units are made with capacities of 3, 5 and 7½ tons.

The Trane Co, La Crosse, Wis.



VAPOR PURIFIERS **P1019**

Purifier of internal type can be used inside steam drums, flash tanks, evaporators, packed towers, bubble-cap towers, deodorizers and stills. Unit is guaranteed to deliver vapor with 1.0 ppm or less of total solids. Available in a complete range of sizes in fabricated steel, stainless steels and other alloy materials. Sizes 4 to 10 in. pass through standard 10x16 in. and 11x15 in. elliptical manholes; sizes 12 to 36 in. are for standard round manholes. Larger sizes, 39 to 72 in., are also furnished. Entrainment is removed from vapor by centrifugal force.

The V D Anderson Co, 1935 W 96th St, Cleveland 2, Ohio.

WELDING ROD **P1001**

Constantly increasing emphasis on chrome-moly steel for repair and production in industry stimulated the development of *EutecTrode 70*, a chrome-and-nickel content electrode specifically designed for repair and maintenance work.

The special composition of this welding alloy, coupled with *FrigidArc* coating, results, according to its maker, in easy application in all positions and an extremely smooth arc action, plus high tensile strength at low amperage. Available in 1/16, 5/64, 3/32, 1/8, 5/32 and 3/16 in. dia.

Dept P, Eutectic Welding Alloys Corp, 172nd St & Northern Blvd, Flushing 58, N. Y.

MEGOHMMETER **P1044**

Vibrotest Model 264 insulation resistance tester has a testing range from 0-100 megohms at 500 volts dc; plus a low-range 0-10,000 ohm scale. The 100-megohm scale (2 megohms center scale) provides range for accurate charting of insulation resistance to show up eteriorating or faulty insulation before it reaches a minimum resistance value consistent with safety.

Pushbutton testing requires no cranking or leveling. Only two binding posts are used for all tests. Unit is completely self-contained, with standard battery power source.

Associated Research Inc, 3796 W. Belmont Ave, Chicago 18, Ill.

T-HEAD SPRINKLER **P1015**

This sprinkler is designed for fixed-piping systems. It has a directional wide angle, medium velocity discharge, and is installed in a pendent position. Sprinkler is recommended for automatic as well as open deluge use and as either a sealed or open head. Water discharge opening is full-size. Water discharged is broken into a fog pattern fine enough to completely fill the area from the ceiling down to the floor. Fog is heavy enough so particles reach any fire on the floor.

Rockwood Sprinkler Co, 38 Harlow St, Worcester 5, Mass.

MERCURY-VAPOR LAMP **P1041**

A basically new light source, 400-watt J-H1 fluorescent mercury-vapor lamp, is designed to provide a whiter light from a mercury-vapor source. Bulb of J-H1 has an inside coat of a phosphor that fluoresces red when activated by invisible ultraviolet light generated by the quartz arc. This tends to balance the spectrum to provide a light white enough for most industrial purposes.

Lower brightness of J-H1 makes operation at lower mounting heights practical. Increased fixture efficiency is obtained by removing the diffusing shield frequently used with the A-H1 type. Electrically similar to the 400-watt A-H1 and E-H1 types, the J-H1 will operate from H-1 ballasts.

Westinghouse Electric Corp, Lamp Division, Bloomfield, N. J.

GAS ANALYZER **P1007**

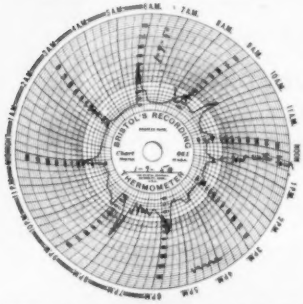
Gas-tight, blast-furnace-gas analyzer and alarm, *the GB*, has a special provision to protect the lens on the lamp and cell from moisture accumulation. The analyzer, a photoelectric type, has the incoming gas brought to the center of a sampling tube. Here the sample gas can flow in either of two ways to exhaust to the atmosphere where it is burned. The outlet to atmosphere is large in relation to inlet because it is necessary to keep pressure constant in the sampling tube.

Two phototronic cells stand at either end of the sampling tube. One cell receives its light direct from the energizing lamp. The second cell receives its light through the gas being analyzed. Difference in output is a measure of how dirty the gas is. The

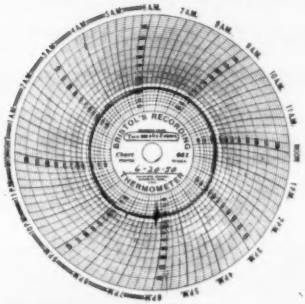
(*Continued on page 168*)

For more data on these items, use post cards, p163. Identify request with P and number.

ONE DAY BEFORE



TWO WEEKS WITH SQUIRES



1. Steam Pressure

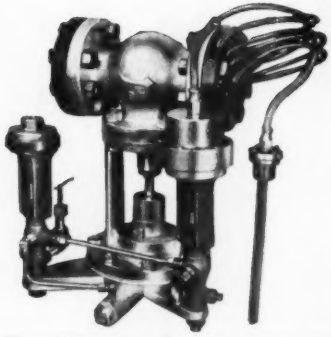
Reduced from 125 Lbs. to 6 Lbs., Maximum, in One Step

2. Temperature

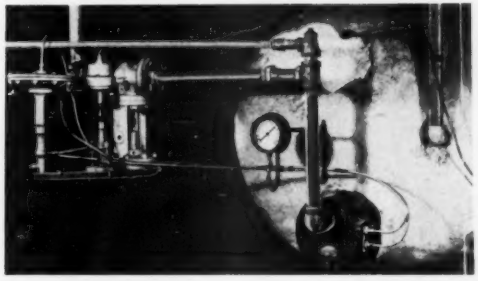
Held at 138—1 Degree Plus or Minus

STEAM PRESSURE AND TEMPERATURE . . .

BOTH MAINTAINED 'ROUND THE CLOCK!



With This Squires Combination Temperature and Reducing Valve At this Akron, O., Plant



Four different makes of pressure reducing and temperature regulating valves proved unsatisfactory for the needs of this Akron, Ohio, company. There were large variations in demand on the 2,000 gallon hot water storage tank shown above. And, water temperatures varied as much as 20° during each 24-hour period.

One 1½" Squires Vertical Combination Temperature and Reducing Valve completely solved the problem. Initial pressure was reduced from 125 lbs. to 6 lbs. in just one step. At the same time, a constant water temperature of 138° (within 1° plus or minus) was maintained. This was done 24 hours a day as can be seen in the chart on top which recorded a typical two weeks' operation.

This dependable performance is typical of thousands of installations of Squires Valves throughout the country. Squires Valves maintain positive, constant reduced pressures within ounces—whether operated by steam, air or water. Every unit a positive dead-end, single-seated valve. Operating and maintenance costs are low. Access to *all* working parts is simple. Main connections do not have to be broken, and a Squires Valve has a by-pass within itself.

Write today and ask for Bulletin #103.

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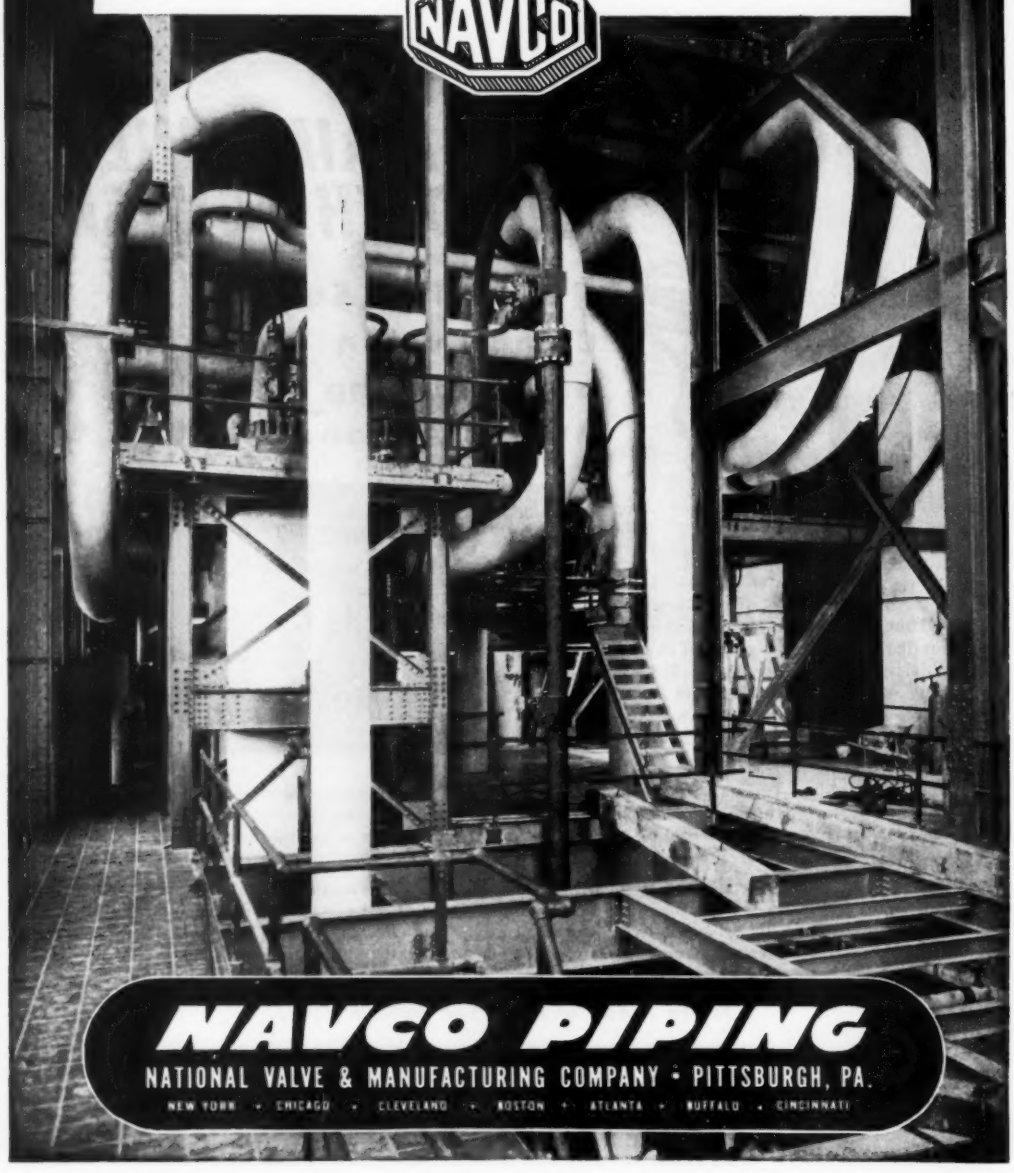
It pays to get NAVCO'S "Know How" and experience in High Pressure and High Temperature piping

For almost half a century Navco has specialized in the fabrication and erection of Piping Systems for the highest operating conditions.

The experience gained throughout that period is your assurance of obtaining from Navco, a Piping System of the highest order.

NAVCO



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BOILERS AND AUXILIARIES

B1 **REFRACTORIES** — Technical information, supplemented with charts, tables and illustrations, on Carbofrax bonded silicon carbide refractories, Alfrax bonded electrically fused alumina refractories, Mullifrax bonded electric furnace mullite refractories, and Monofrax fused cast refractories. 20-page booklet. Carborundum Co, Refractories Div, Perth Amboy, N. J.

B2 **COAL FLOW STOKERS** — Two bulletins describing the PCF series Poweram coal flow stokers and the CF coal flow stokers are available. Both these underfeed stoker designs feed coal directly from the bunker to the combustion chamber of the boiler or furnace at a rate to meet exact load demand. 4 pages each. Iron Fireman Mfg Co, 3170 W 106th St, Cleveland, Ohio.

B3 **SUSPENDED ARCHES**—Descriptive of the new Reintjes firing arch developed primarily to serve as a tight connection between the fan-tail nosing and the chill walls of open-hearth furnaces. Also applicable for use in glass tanks, and melting furnaces, including incinerators and flues. 4-page bulletin No. 651. Geo P Reintjes Co, 2517-19 Jefferson St, Kansas City 6, Mo.

B4 **STOKERS**—Data on Detroit Rotostokers for steam generators including packaged types given in Bulletin No. 501. Detroit Rotograte stokers and how they serve a particular plant are described in Bulletin No. 49. 4 pages each. Detroit Stoker Co, General Motors Bldg, Detroit 2, Mich.

B5 **PACKAGED STEAM GENERATORS**—A discussion of Steam-Pak packaged steam generators, high pressure operation for processing applications. Operating and installation advantages as well as specifications and ratings are given. 12-page bulletin No. ID-51. York Shipley, Inc, York, Pa.

CONTROLS, MECHANICAL

B6 **TEMPERATURE REGULATORS** —Presents data on precision pressure regulators, temperature regulators and combination pressure and temperature regulators. Includes dimensions, application, capacity, engineering tables and specifications. Bulletin No. 751. O C Keckley Co, 400 W Madison St, Chicago 6, Ill.

B7 **LIQUID LEVEL CONTROLS** — Contains facts about liquid level controls for special applications, float controls, and related devices. Valuable in solving special boiler water level

(*Continued on page 164*)

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More FREE LITERATURE

Begins on page 143

control, liquid level control and relief valve problems. 20-page catalog No. SC-1. McDonnell & Miller, Inc, 3600 N Spaulding Ave, Chicago 18, Ill.

B8 GOVERNORS—"How To Get The Most Out of Your Governor" gives a complete presentation of centrifugal governor problems and applications. Illustrated with photographs and schematic drawings. Details on adjustment, care and maintenance are also included. 12-page booklet. Pierce Governor Co, Inc, Anderson, Ind.

B9 LIQUID HANDLING EQUIPMENT—Folder, "1001 Ways That Bowser and Its Subsidiaries Serve You Every Day," acquaints the reader with the company's very extensive line of liquid handling equipment. 12-page folder. Bowser, Inc, Fort Wayne 2, Ind.

ELECTRICAL EQUIPMENT

B10 ELECTRICAL MEASURING INSTRUMENTS—Gives information on how to select electrical measuring instruments and solves four typical selection problems. Complete lines of portable, switchboard, panel, recording and socket instruments are also described and illustrated, and functions of each are explained. 30-page booklet No. B-4696. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

B11 PACKAGED ELECTRIC POWER—Outlines methods of obtaining electric power equipment for quick expansion at low cost and with a minimum of critical materials. Includes 52 photographs and diagrams. 24-page bulletin No. 5600. General Electric Co., Apparatus News Bureau, Schenectady 5, N. Y.

B12 STORAGE BATTERIES—Three data sheets give design specifications for single, double, and triple-tier racks for installing 12, 24, 30, and 60-cell batteries. Each sheet comprises keyed line drawings and dimension tables of racks to be used with different cell sizes. Sheets Nos. 72056, 72057, and 72074. Gould-National Batteries, Inc., Trenton 7, N. J.

INSULATION, HEAT, COLD AND VIBRATION

B13 VIBRATION ISOLATORS—Covers a new line of All-Metal vibration isolators in a range of 8 to 16 lbs, 14 to 25 lbs, and 22 to 35 lbs. All units are available in the 6600 series, the 6645 series, the 6600R series, and 6645R series. Revised catalog No. 509. Barry Corp, 855 Pleasant St, Watertown 72, Mass.

B14 INDUSTRIAL INSULATION—Discusses Foamglas, a cellular glass insulation, for piping and process equipment. Included are properties; typical data for cold, intermediate, and hot applications; details for insulating tanks, ducts, removable covers, and tank heads; accessory materials; prominent users and distributors. 24-page bulletin No. G1839. Pittsburgh Corning Corp, 307 Fourth Ave, Pittsburgh 22, Pa.

B15 HEAT AND VAPOR FLOW—Revised edition of "Simplified Physics of Vapor and Thermal Insulation," contains information on heat and vapor flow, vapor permeability, condensation, conduction and density, convection, radiation and emissivity, reflection and absorption, plus many other subjects. 56 pages. Infra Insulation, Inc, 10 Murray St, New York, N. Y.

B16 INDUSTRIAL CORK—Describes characteristics and uses for cork compositions and natural cork. Includes tables giving physical properties of both types, sheet sizes and Dodge equivalents of government specifications for cork compositions, and standard taper cork sizes. 4-page bulletin. Dodge Cork Co, Inc, Lancaster 19, Pa.

MAINTENANCE AND SAFETY EQUIPMENT

B17 BLAST CLEANER—Describes Vacu-Blaster, a tool for blast-cleaning metal, concrete, brick, stone or wood surfaces. Blast cleaner has a vacuum pick-up and reclaims and reuses abrasives, collects dirt and debris. 28-page bulletin No. 2159. Vacu-Blast Co, Inc, 350 Peninsular Ave, San Mateo, Calif.

B18 MAINTENANCE TOOLS—Covers a complete line of 4,000 tools such as socket wrench equipment, hand tools, punches, chisels, screwdrivers, pliers, tool boxes, etc, for servicing operations and maintenance work throughout industry. Complete specifications. 104-page catalog No. 711. Snap-on Tools Corp, Kenosha, Wis.

B19 TURBINE OIL MAINTENANCE—Illustrates and describes dry-type oil maintenance methods for the bearings of modern turbines. Importance of continuous oil maintenance and factors which cause turbine oil deterioration are explained by charts, diagrams and phantom views. 12-page bulletin No. 832-P. Bowser, Inc, Fort Wayne 2, Ind.

MAINTENANCE MATERIALS

B20 DUCK AND RUBBER PACKINGS—Gives service recommendations for various types of duck and rubber packings, lists the standard sizes in which each is available and gives packaging specifications on all types. 8-page bulletin. Raybestos-Manhattan, Inc, Packing Div, Manheim, Pa.

B21 SERVICE FLOORING—Information on how and where to apply Plastic Rock flooring as well as technical data about the product itself. The use of Plastic Rock for resurfacing heavy traffic areas is highlighted. 8-page brochure No. 200. United Laboratories, Inc, 16801 Euclid Ave, Cleveland 12, Ohio.

B22 LIQUID WATER REPELLENT—Product information and application bulletin on H2-O-NO, silicone base liquid water repellent for masonry. Instructions for using it, technical data, coverage facts, etc, are included. Chem Industrial Co, 1114 Hippodrome Bldg, Cleveland 14, Ohio.

B23 INDUSTRIAL FLOORS—Booklet, "Why Engineer An Industrial Floor" describes how the Flash-Stone system engineers floors to withstand moving and deadweight loads, shocks and vibration, extremes of temperature and other destructive agents. 12 pages. Flash-Stone Co, Inc, Philadelphia 44, Pa.

MATERIALS HANDLING

B24 CONVEYOR IDLERS AND MACHINERY—Information on the latest designs and developments of Rex Belt conveyor idlers and machinery. Included are sections devoted to engineering data, lubrication material and techniques, and correct maintenance procedure. 42-page bulletin No. 51-81. Chain Belt Co, Dept PR, 1600 W Bruce St, Milwaukee 4, Wis.

B25 LIFT TRUCK—Operating data, dimensions, specifications on pneumatic tire models FPB20-24 and FPB20-15 fork trucks in capacities from 2000 lbs to 4000 lbs at 15 and 24 in. load centers. 4-page bulletin No. 1550. Buda Co, Harvey, Ill.

B26 FEEDERS AND CONVEYORS—Describes a line of Jeffrey-Traylor electric vibrating feeders and conveyors. Instantaneous and absolute control over flow of material is electrical and

(Continued on page 222)

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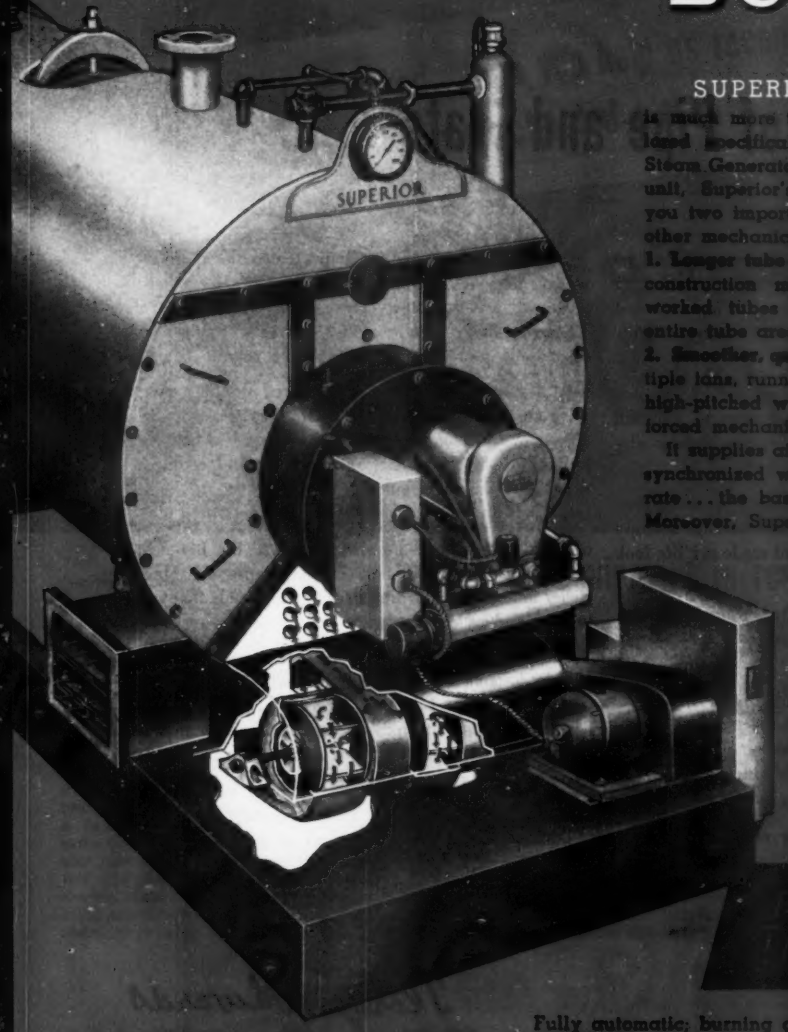

SUPERIOR'S INDUCED DRAFT is much more than necessary equipment. Tailored specifically to its function in Superior Steam Generators, and built-in as an integrated unit, Superior's Induced Draft System offers you two important advantages not common to other mechanical-draft boilers.

1. **Longer tube life** . . . because full-width fan construction minimizes the danger of overworked tubes by its even draw across the entire tube area.

2. **Smoother, quieter operation** . . . because multiple fans, running at low speeds, eliminate the high-pitched whine commonly associated with forced mechanical draft.

It supplies air in precisely measured volume, synchronized with the oil flow at every firing rate . . . the basis of high operating efficiency. Moreover, Superior's Induced Draft eliminates the possibility of forcing combustion gases into the boiler room.

These, in themselves, are very substantial reasons for specifying Superior Steam Generators; but for the whole story, write for Catalog 301.

STEAM GENERATORS

Fully automatic; burning gas or oil, or both.
80% thermal efficiency guaranteed.
18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i.

Superior Combustion Industries, inc.

Factory Emmaus Pa
Executive Offices Times Tower, Times Square New York 18 N Y

My Cathedral of Pipe and Plate

I suppose every man jack of us has his own kind of religion, a belief in something that's just a little bit bigger than we are. I know I have. But most of the time I forget about such things and think instead that I'm running my own show.

Like all of us, I've got problems, on and off the job, real and imaginary. Sometimes they seem to snowball until I can't see past them . . . then I begin to wonder why I keep beating my head against the wall.

For the past few weeks I'd been building myself up into just such a mood. A combination of circumstance with my own stupidity and bullheadedness had made my life look like it was becoming a hopeless snarl.

Then all of a sudden the cloud lifted, when I least expected it, and through no fault of my own or anybody else.

I was standing in the engine room the other afternoon. For some reason or other none of the men was in sight. And as I stood there soaking up the music of the engines, despite all my problems I got a wonderful feeling of power —personal power.

Because, after all, wasn't this my engine room, and wasn't I the boss? Or was I?

Neither I nor any other man created the power that was turning those engines, any more than we created the power of life that flows through our bodies. No sir! The power that turned those engines was *borrowed* power, same as the power of life we value so highly.

And it suddenly dawned on me that I wouldn't have to solve all my problems, alone. Many of them would disappear or be taken care of for me. All I had to do was to live one day at a time, and do the best I could each day. Beyond that I could do no more.

And then suddenly I was back in the everyday world of work and play that I'd always known. But I somehow feel that life for me in this everyday world will become richer and more rewarding despite the trouble that seems to surround us constantly.

Because in that brief moment that the power plant I work in became a cathedral of pipe and plate, I re-learned something I hope I'll never forget . . . that above and beyond us is a greater power that's willing to help whenever we're willing to admit that we can't run the show by ourselves.

That knowledge to me is more important than all the engineering know-how I've picked up in the last thirty years.

George Edwards

Engineer

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS

Dowell Service cleans "mothball" equipment in record time!

Reactivation of standby plants involves many problems! One of the most important is the quick reconditioning of equipment put in mothballs over five years ago. With years of experience in cleaning all types of industrial equipment, Dowell can give *fast, efficient* reconditioning service.

Just recently, an ordnance plant was reactivated after being out of service for over five years. The internal surfaces of two boilers in this plant were coated with a heavy hydrocarbon preservative plus some underlying water deposits. There was also rust in the sections left uncoated. *In just 3½ days,* Dowell Service *completely cleaned* these boilers, putting them in operating condition except for necessary mechanical repairs. In this same plant, two deaerator heaters and the filtered water piping system were also cleaned quickly with Dowell Service.

If you are reactivating a plant or faced with a cleaning problem in your industrial equipment . . . call in Dowell Service. *Without dismantling and with a minimum of downtime,* trained Dowell engineers introduce special solvents designed to dissolve and disintegrate the "mothball" preservatives or accumulated deposits. Dowell-designed pumps and control equipment are used to do the job right in your plant. Phone the nearest Dowell office . . . an experienced Dowell engineer will be glad to give FREE consultation on your particular industrial cleaning problems.

Other recent Dowell jobs:

Two superheaters, each with over 5½ miles of tubes, were cleaned by Dowell Service. Result: An estimated 3400 lbs. of profit-stealing deposits were removed.

•

Cooling coils on 3 air conditioning units were so badly fouled that units operated inadequately. Dowell Service cleaned the coils in 8 hours. Result: Units are now operating as designed.

•

A hot water supply line to a hospital was clogged with deposits. Water pressure at normal usage was only 25 lbs. . . . insufficient to raise water to top floor. After Dowell cleaning: Pressure stayed up to 65 lbs.

CALL

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Long Beach, Oakland, Casper: Dowell Associate—International Cementers, Inc.

★ *Maintenance cleaning service for industrial heat exchange equipment.*
★ *Chemical services for oil, gas and water wells.*
★ *Magnesium anodes for corrosion control.*

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A Service Subsidiary of
THE DOW CHEMICAL COMPANY

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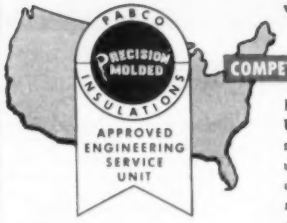
PABCO PRECISION MOLDED 85% MAGNESIA HEAT INSULATION

MEANS NATION-WIDE SERVICE

MODERN ENGINEERING demands precise standards of heat insulation performance. Pabco's *Precision Molded* 85% Magnesia combines the time-tested superiority of Magnesia with precision molding to give you a light weight insulation manufactured to very close tolerances.

LOCAL STOCKS

Pabco Engineering Service Units are strategically located throughout the United States and maintain adequate stocks of Pabco's *Precision Molded* 85% Magnesia Heat Insulation. Regardless of your location, Pabco Engineering Units give the service and materials you need when you need them.



COMPETENT INSULATION ENGINEERS

Each Pabco Approved Engineering Service Unit is staffed with competent insulation engineers and skilled mechanics. Between each unit and the Pabco factory there is a constant cooperative interchange of experience and methods, resulting in special benefits to every customer.

SERVICE EVERYWHERE

Pabco Engineering Service Units may be found in the classified section of the telephone book, or by writing to the factory. You can depend upon every Pabco Engineering Service Unit for the same high standards of materials, workmanship and methods of application. Get the complete facts on Pabco heat insulation and service now for your future needs.

THE DEPENDABLE STANDARD — "MODERNIZED"

quality

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Insulation Division

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Manufacturers of Heat Insulation Since 1920

Pabco Engineering Service Units in all Principal Cities

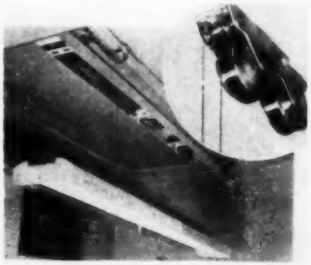
More EQUIPMENT NEWS

Begins on page 154

recorder has to be calibrated for each type of gas and for each setting of the sampling tube.

General Power Plant Corp, 381 Fourth Ave, New York 16, N. Y.

For more data on these items, use post cards, p163. Identify request with P and number.



LIGHTING FIXTURE P1040

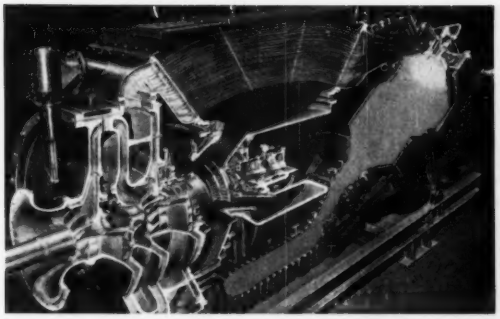
Counterbalancing device allows cleaning and servicing of fluorescent lighting fixtures by regular plant housekeeping folks working at floor level. Industrial and commercial lighting fixtures of all sizes may be drawn down from any operating height to remain stationary at a convenient level for replacement of tubes or starters and cleaning of reflecting surfaces. Power is automatically disconnected from each fixture as it is lowered.

Counterbalancing of fixture's weight at all levels is provided in minimum space by two *Neg'ator* B-motors (see photo insert) mounted fixture housing. In the B-motor, the *Neg'ator*, a strip of flat spring material formed so its relaxed shape is a tight coil, is wound from the storage bushing (on the right) onto the output bushing carrying the cable drum as the fixture is pulled down. The constant counterbalancing force is produced by the *Neg'ator* trying to return to its relaxed shape on the storage bushing.

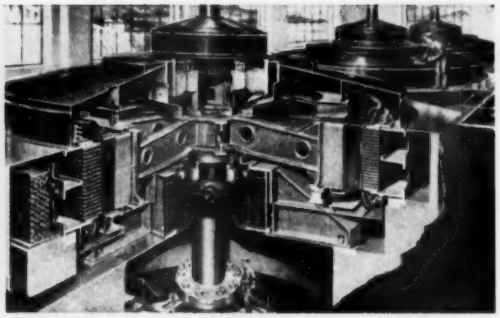
The Thompson Electric Co, 1112 Power, Cleveland, Ohio.

FIRE DETECTOR P1021

Detect-A-Fire gives an alarm at the moment air temperature around it reaches the value for which it was preset. Unit is mounted on the ceiling and can be used in schools, hotels, hospitals, offices, public and mercantile buildings, warehouses and ships. Fixture mounts in a curved steel case, may be set up to 325 F, and can cover



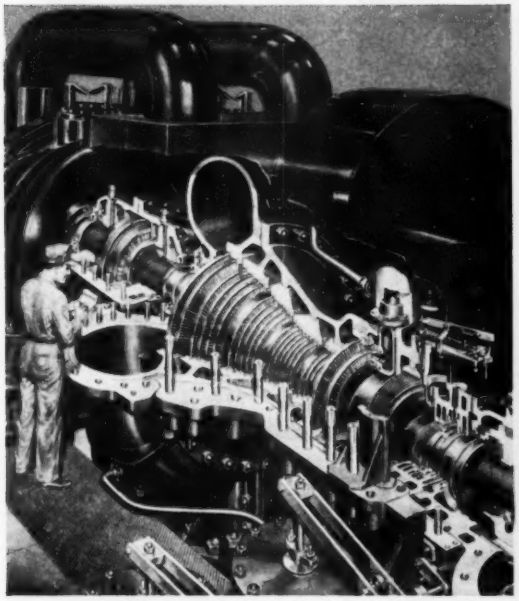
GAS TURBINES—only recently put to industrial use—are proving highly efficient. Socony-Vacuum aided in their development—lubricates the first gas-fired and first coal-fired turbines placed in operation.



HYDRAULIC GIANTS—of type shown—have rotating parts with combined weight and thrust of 250 tons! Microscopically thin films of a famous Gargoyle oil protect these vital parts against damage and wear!

FIRST IN TURBINES

with the Biggest, the Most, the Latest!



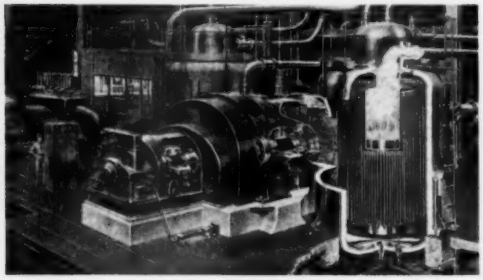
STEAM TURBINES—from the smallest to the world's biggest—are charged with famous Gargoyle oils. In fact, more turbines of 5,000 KW and over are lubricated by Socony-Vacuum than by any other oil company!

Why Accept Anything Less?

Among the many claims made for various turbine oils, one *fact* stands out . . . more turbines of 5,000 KW or larger are lubricated by Socony-Vacuum than by any other oil company! Here's why—

Famous Gargoyle D.T.E. oils are top quality—backed by 85 years of lubrication experience. They protect fully over unusually long periods, give extra long service life, help turbines run more continuously with less need for maintenance.

Why accept anything less for *your* turbines?



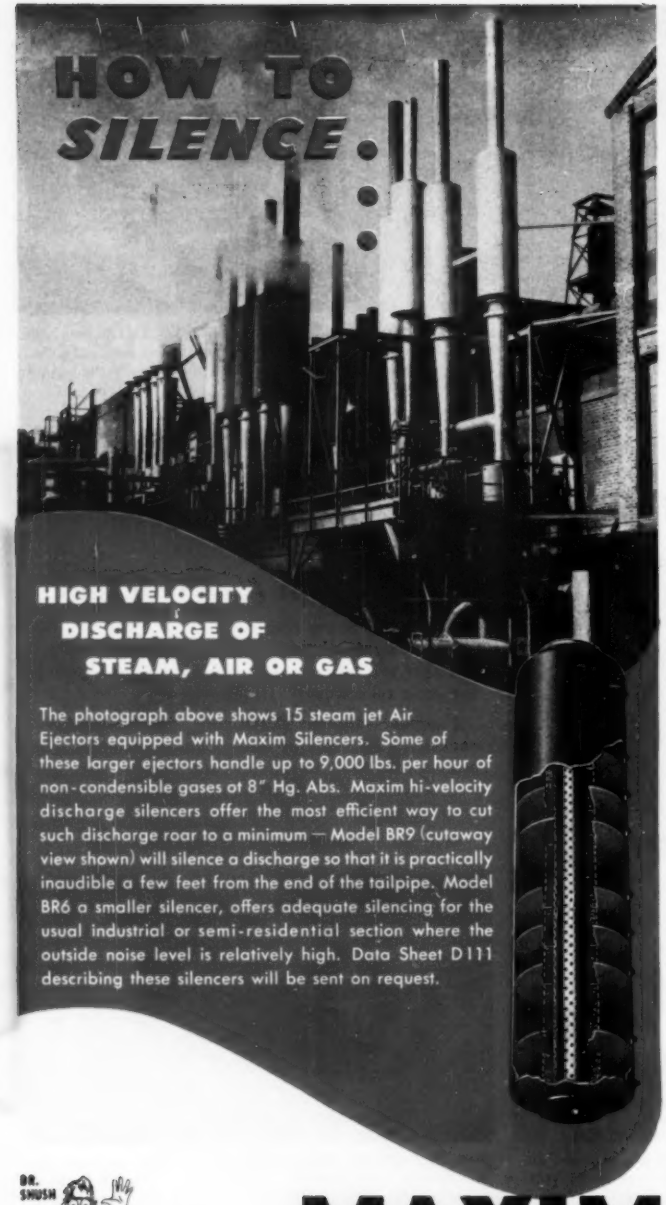
MERCURY-STEAM POWER PLANT—first ever designed and coordinated as a unit station—combines two 7,500-KW mercury turbines with a 25,000-KW steam turbine. The entire unit is 100% Gargoyle-lubricated!

SOCONY-VACUUM OIL CO., INC.
and Affiliates:
MAGNOLIA PETROLEUM CO.
GENERAL PETROLEUM CORP.

SOCONY-VACUUM
GARGOYLE
Lubricants

SOCONY-VACUUM
Correct Lubrication

WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE



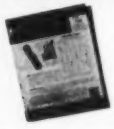
HIGH VELOCITY DISCHARGE OF STEAM, AIR OR GAS

The photograph above shows 15 steam jet Air Ejectors equipped with Maxim Silencers. Some of these larger ejectors handle up to 9,000 lbs. per hour of non-condensible gases at 8" Hg. Abs. Maxim hi-velocity discharge silencers offer the most efficient way to cut such discharge roar to a minimum — Model BR9 (cutaway view shown) will silence a discharge so that it is practically inaudible a few feet from the end of the tailpipe. Model BR6 a smaller silencer, offers adequate silencing for the usual industrial or semi-residential section where the outside noise level is relatively high. Data Sheet D111 describing these silencers will be sent on request.

Consult MAXIM

THE MAXIM SILENCER COMPANY 92 HOMESTEAD AVE., HARTFORD 1, CONNECTICUT

Gentlemen: Please send for bulletin on High Velocity Discharge Silencer



NAME _____

COMPANY _____

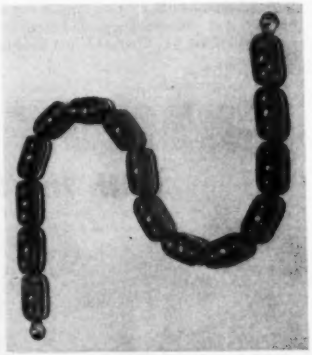
ADDRESS _____

More EQUIPMENT NEWS

Begins on page 154

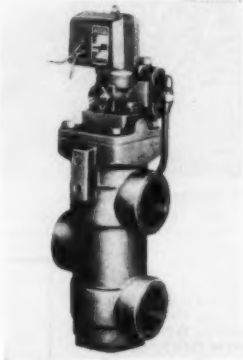
an area up to 625 sq ft with a single unit. It is repeatable, resetting itself accurately after each alarm. Device carries U.S. Coast Guard and Factory Mutuals Laboratories approvals and is listed by Underwriters' Laboratories, Inc.
Fenwal, Inc., Ashland, Mass.

For more data on these items, use post cards, p163. Identify request with P and number.



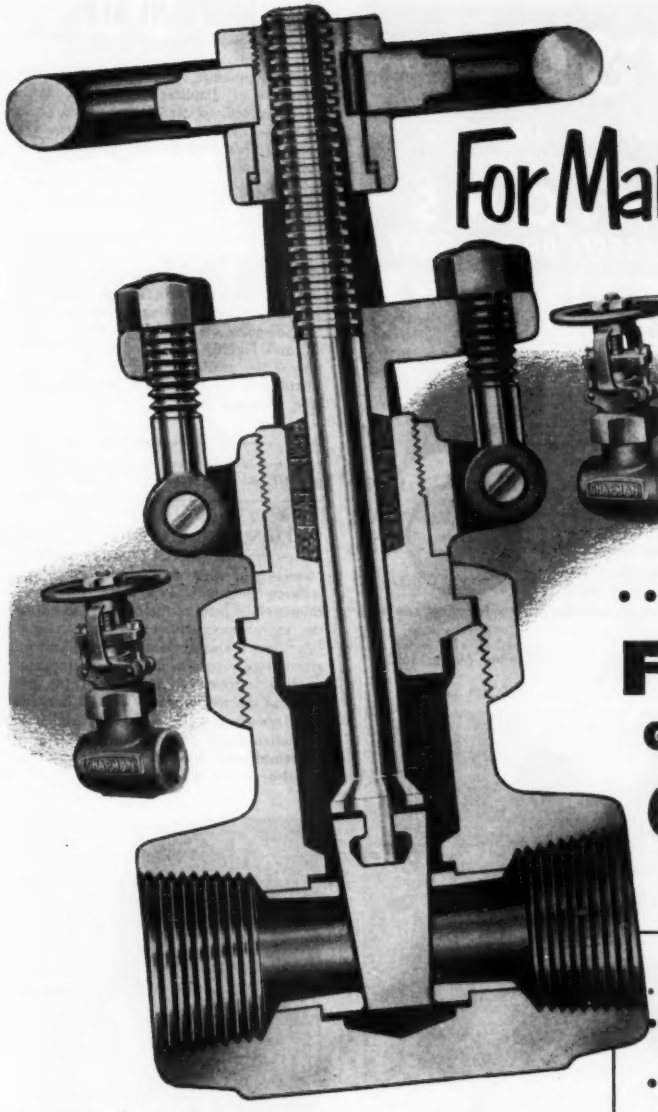
LEATHER V-BELT **P1043**

Leather link construction, double-faced V-belting. Each link consists of two fiber sections faced with oak-tanned leather. Steel connectors insure great flexibility and eliminate stretch. Leather segments are V-faced to provide a double bevel that conforms to standard V-belt sheaves. The double-V feature prolongs useful life of belt since on straight drives it can be turned over to become equivalent of a new belt.
Graton & Knight Co, 348 Franklin St, Worcester 4, Mass.



3-WAY PILOT-CONTROLLED PACKLESS VALVE **P1014**

Three-way pilot-controlled valve (Bulletin No. 8331) is designed for controlling automatically alternate application and ex-



For Many Services

. . . Use this same FORGED GATE VALVE CHAPMAN LIST 960

. . . In these different alloys

- Carbon steel forgings with stainless steel (12-14 chrome) trim.
- Stainless steel (12-14 chrome) forgings with stainless steel (12-14 chrome) trim.
- Stainless steel (18-8) forgings and stainless steel (18-8) trim.
- Alloy steel (4-6) chrome body forgings with stainless steel (18-8) or Cyclops trim.

To all the many jobs for which it's qualified, Chapman List 960 brings *extra* wear-resistance in exclusive features like these:

Extra strength of stem-and-wedge gate connection provides protection against even unusual service stress.

Super-hardened seat rings and wedge-faces of stainless steel.

Bolted Follower with no follower threads on yoke to corrode. Follower easily tightened down any time when necessary.

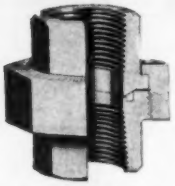
List 960 comes in sizes from ¼" to 2". Joints either gasketed or metal-to-metal. Two types: Rising stem with yoke (shown), or rising stem with inside screw. Pressure range: 2000 lb. at 100°F.—380 lb. at 1000°F. (For higher pressures, specify List 990.) Send for illustrated bulletin on List 960.

The CHAPMAN Valve Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

Jefferson

AIR-REFINED, AIR-TESTED
MALLEABLE IRON
UNIONS
... featuring the RECESSED BRASS SEAT

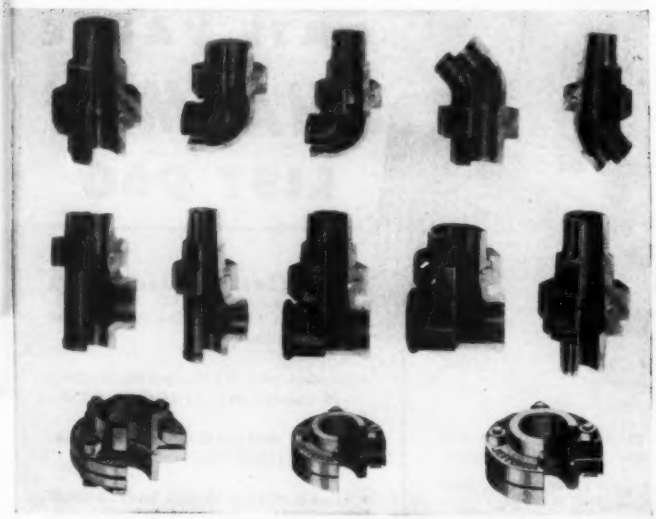
ALL your piping needs are served by "JEFFERSON"



Inasmuch as the Jefferson line includes convenience unions in all-female and male-female types, as well as flange unions, a complete service is available to help simplify your piping installations.

Then, too, Jefferson offers the easy set-up and permanently tight feature of the Recessed Brass Seat. This construction consists of a brass ring cut from seamless drawn tubing (instead of a casting) which is forced into its machined retaining channel under high pressure, resulting in a joint which cannot work loose or rock. Location of this joint is such that pipe ends cannot come in contact with it.

The Jefferson line includes AAR 300#, Enduro 300#, Excel 250# and Master 150# Unions. All-iron seat unions are also available in all types.



Your nearest distributor can supply you—or get in touch with us direct.

Jefferson UNION CO.
605 W. 26th St., New York 1, N.Y.
63 Gooding St., Lockport, N.Y.
39 Fletcher Ave., Lexington 73, Mass.

More EQUIPMENT NEWS

Begins on page 154

haust of pressure to and from equipment, cylinders or diaphragm chambers, as in operation of diaphragm motor valves, air or hydraulic cylinders, etc. When solenoid is energized, exhaust port is closed and pressure is applied to the delivery port. When solenoid is de-energized pressure supply is cut off and delivery port connected to exhaust.

Valves are suitable for handling air, gas, oil or any noncorrosive fluid at a temperature not above 180 F. Pipe sizes are 1, 1¼, 1½ and 2 in., each with designs suitable for 125 and 250 psi operating pressures. Standard solenoids are for 115 or 230 v, ac or dc, and for 25, 30, 50 or 60 cps. Other ratings also available.

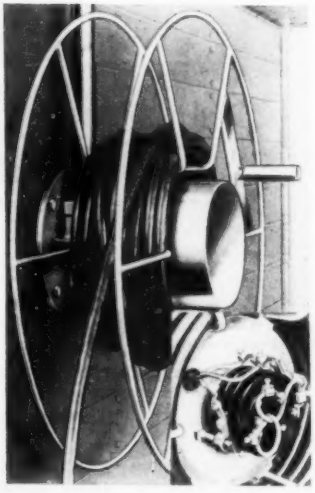
Automatic Switch Co, 379-D Lakeside Ave, Orange, N. J.

For more data on these items, use post cards, p 163. Identify request with P and number.

WELDING-ARC CONTROL P1009

New arc drive-control produces electrical transient characteristic desirable for certain welding operations. Type RA selenium rectifier welder permits the operator to adjust the arc characteristic to suit a particular job. Device operates automatically and instantaneously to provide an extra surge of welding current at the moment the arc becomes shorted, either by contact between the electrode and the work or by a globule of molten metal bridging the arc gap.

Westinghouse Electric Co, Box 2099, Pittsburgh 30, Pa.



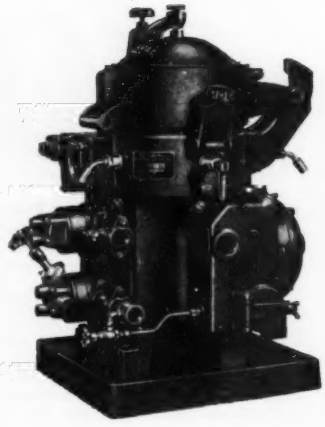
CABLE REEL P1039

Wall-mounting *Powereel* can be permanently mounted on truck, walls and other places to ease handling of heavy electrical cable. Unit has a special mounting flange on side so it can be fastened to

KEEP AWAY FROM DOUBLE TROUBLE WITH A DE LAVAL OIL PURIFIER

Some "trouble" may not be as bad as it sounds, but turbine lubricating oil difficulty is best prevented right from the start. Centrifuging the oil by means of a De Laval Oil Purifier is the surest way to have a full supply of clean lubricating oil circulating through the system. The De Laval machine removes by means of centrifugal force both the solid and the liquid impurities that impair the usefulness of the oil.

All of the dirt is thrown out of harm's way and stored in the bowl until it is ready to be cleaned. Any water present is instantly and continuously discharged to waste.



De Laval centrifuges do not remove any oil-soluble additives. Since most turbines have comparatively little water trouble, the amount of inhibitor of any kind that is lost is inconsequential. It is important, however, to note that should a leak occur, the De Laval provides the necessary means of getting rid of the excess water instantly.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL LUBRICATING OIL PURIFIERS

Choose the Valves You Need from . . .
the Complete Line of
R·P&C VALVES

FIG. 400 Bronze Globe Valve

When you choose R-P&C Valves, you can be sure of the same high quality of each one—from tiny ⅛" valves . . . to high-pressure, high-heat valves . . . and giant valves for handling huge volumes of liquids.

- You can get bronze, iron, steel—bar stock—iron cocks—and cast steel fittings. Two new numbers are PRESSURE SEAL BONNET and FORGED STEEL GATE. New ones coming.
- Call your local R-P&C distributor today or write the nearest R-P&C district office.

ACCO
Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

"Intentionally Better"
READING-PRATT & CADY VALVES

More EQUIPMENT NEWS

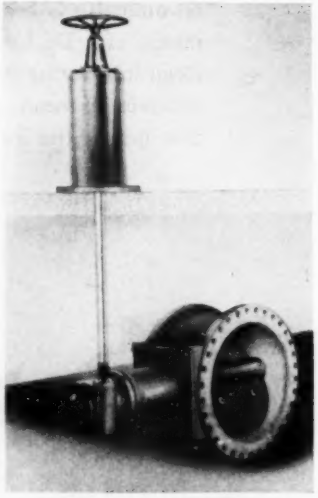
Begins on page 154

a base with four ⅜-in. bolts. This flange is threaded to fit a 1-in. iron conduit or give a water-tight connection for flexible feeder cables. This new model accommodates sizes up to No. 4 four-conductor cable.

Collector ring assembly is standard so no interruption in current is caused during winding or unwinding of cable. Rings are of heavy beryllium copper with double constant-contact brushes seated in a phenolic casting and housed in metal. Reel is available in any size with either a 75-amp collector ring for 2, 3 or 4 conductors or a 30-amp collector ring for up to 16 conductors.

Industrial Electrical Works, Dept 35, 1511 Chicago St, Omaha 2, Neb.

For more data on these items, use post cards, p163. Identify request with P and number



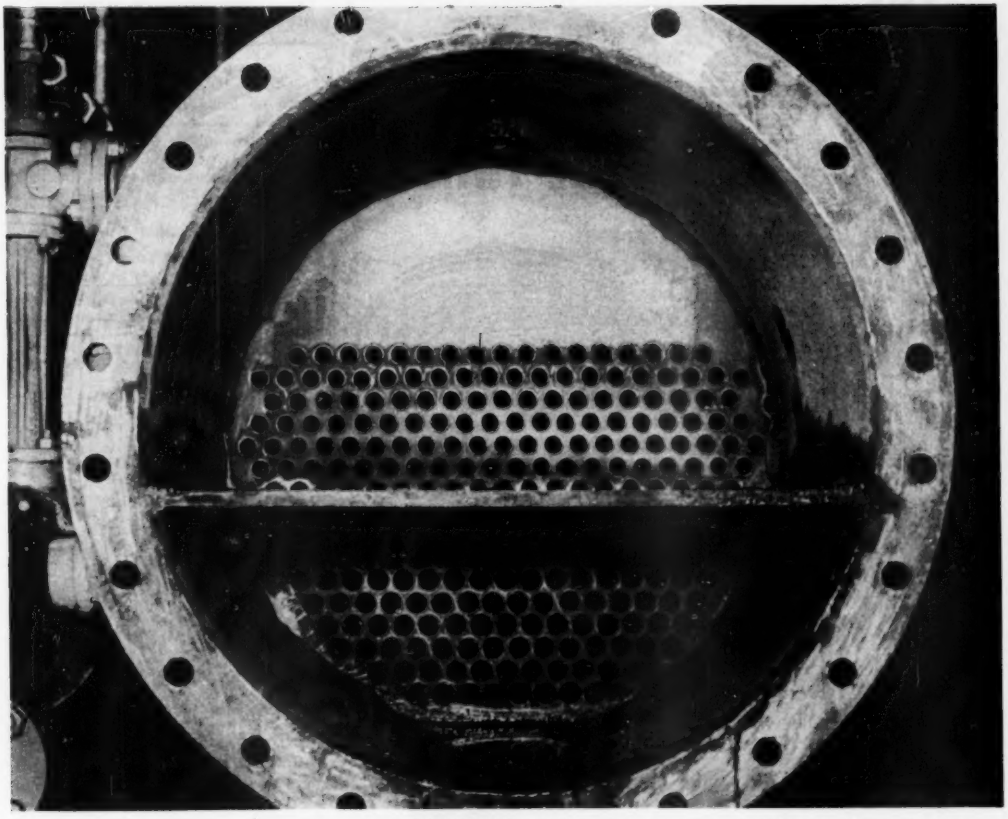
MANUAL CONTROL VALVE P1012

Heavy-duty valve No. 788 has totally enclosed gear-reduction drive, extended shaft and floor stand. Sealing of water pressure obtained by babbitted seat in body, and monel or stainless steel welded to the periphery of valve disk. Metal-to-metal seat gives shutoff suitable for most installations. With a 350-ft head of water on a 36-in. valve, leakage with a babbitted seat is 50 gph. Remote, automatic or semi-automatic controls also available for this type valve.

R-S Products Corp, 4600 Germantown Ave, Philadelphia 44, Pa.

CONCRETE CUTTER P1003

Labor-saving, diamond-blade, masonry cutting-tool enables contractors or industrial plant maintenance men to actually saw patches, trenches or contraction joints in building floors and streets made of con-



WITH SANTOPHEN 45—This is an unretouched photo of an inter-cooler condenser, which had not been cleaned since the beginning of the Santophen 45 test in late 1949. The unit contained no slime and practically no corrosion.

Proof that Santophen 45 controls slime

Proof of the effectiveness of Santophen 45 in controlling bacterial and algal slime is established by these figures:

During 1948 and 1949, before Santophen 45 (sodium trichlorophenate, technical) was introduced, the slime problem was acute in Monsanto's 12,000-gallon-capacity air-conditioning cooling tower. To keep the system efficient, from three to five mechanical slime cleanouts were needed yearly. Cleanouts cost from $300 to $500 each.

Here are results of a definite period of observation after the introduction of Santophen 45: On July 3, 1950, Santophen 45 was added to the water at the rate of 100 parts per million. This required only 10 pounds of Santophen 45 for the 12,000-gallon system. Such applications were made biweekly until later in the fall when they were put on a weekly basis. In all, 350 pounds of Santophen 45 were used at a cost of $119. Throughout the year, the exchangers gave a high level of heat transfer and *did not require a single shutdown for mechanical cleanout.*

If you have a slime problem, get the details on Santophen 45. Your request, on business stationery, will bring you a test sample, technical data and availability information. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second St., St. Louis 4, Mo.

Santophen: Reg. U. S. Pat. Off.

MONSANTO
CHEMICALS AND PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

THE

spring

IS THE THING!

KNIFE-EDGES *BITE* INTO FLANGE SURFACES

AJAX

SPIRAL WOUND GASKETS

The gaskets with more "bounce to the ounce" of bolt load. Built-in resilience for positive permanent seals.

Made for all types of pipe flanges, pressure vessels, boiler manholes, handholes, tube caps, water walls, economizers and other boiler accessories. Ask your supply house. AJAX gaskets, are universally available through Industrial Distributors.

PRESSURE-SEALED

THEY *BREATHE* WITH VARYING PRESSURES AND TEMPERATURES

HEAT EXCHANGER GASKETS

Double jacketed metal-asbestos, precision made to specifications in any desired size, shape or metal. Estimates furnished on receipt of details. Write

LIGHTER BOLT LOADS. SAFER SEALS

UNITED STATES GASKET COMPANY

680 N. 10th Street Camden 1, N. J.

NO DRIP—NO SQUIRT—NO HISS

Leading Fabricators of "TEFLON" for the Chemical, Process and Electronic Industries.

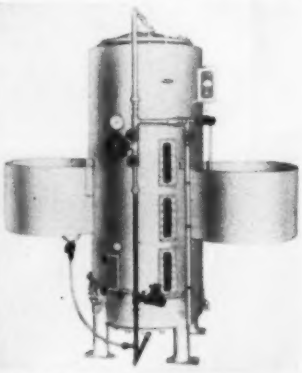
More EQUIPMENT NEWS

Begins on page 154

crete or asphalt. For instance, concrete containing limestone aggregate can be sliced up to 10 fpm when cutting at a depth of 1 in. Specifications of the new blades are available for all types of aggregate and age of concrete. Blades are available in diameters from 8 to 18 in. and in thickness of 5/32 to 7/64 in. for any type concrete saw.

Clipper Mfg Co, 2800 Warwick, Kansas City 8, Mo.

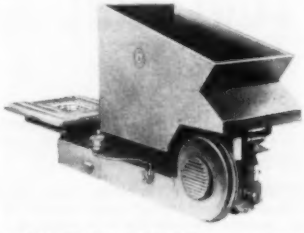
For more data on these items, use post cards, p163. Identify request with P and number.



MONO-BED DEMINERALIZER P1029

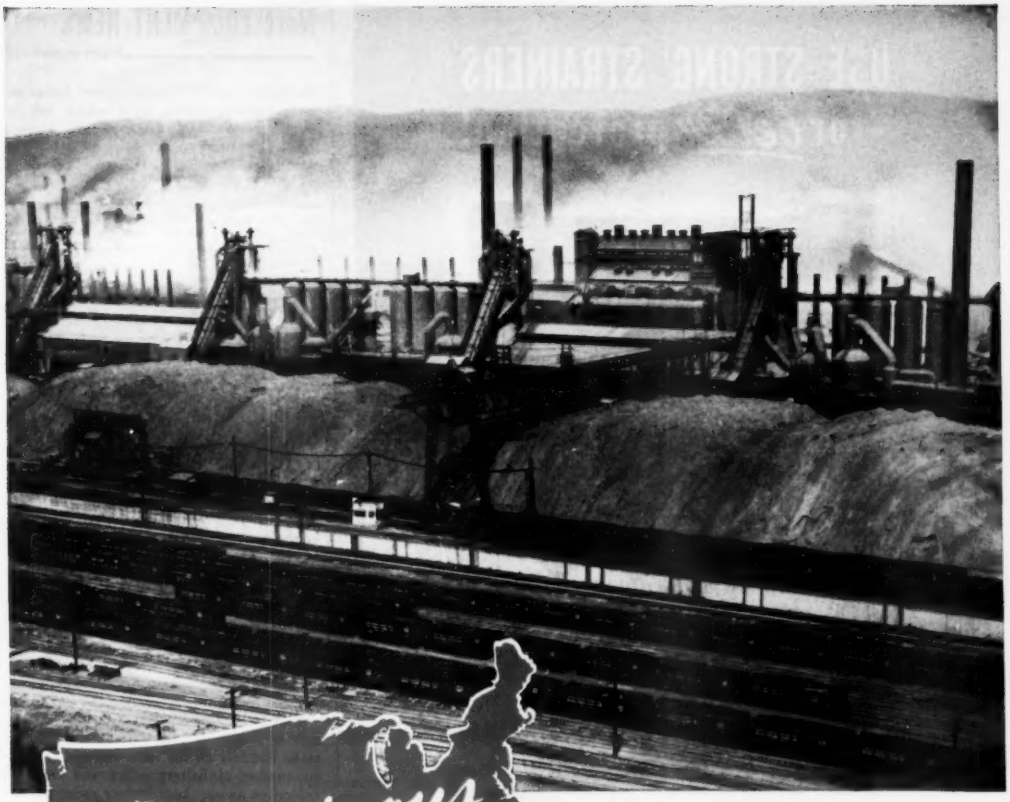
Cation and strong base anion exchangers are intimately mixed in a single unit tank housing the manufacturer's mono-bed demineralizer. Raw water passes through the exchanger column only once and in some instances has come out with a mineral content close to zero (resistances of 20,000,000 ohms per centimeter). Models are available in flow rates from a few gallons per hr to 5000 and up.

Penfield Mfg Co, Inc, 19 High School Ave, Meriden, Conn.



COMMERCIAL STOKER P1005

Commercial hopper-model stoker has been refined to permit easier hopper-filling and to avoid interference with boiler-flue-cleaning doors. The hopper has been lowered in height and is now fully open and sloping on the top. It comes in two sizes designed for warm air, steam or hot water systems as well as industrial applications. A metering-type worm takes the coal from



Bituminous

is indispensable to the power of America

The bituminous coal industry
has the strength—the know-how—
to meet *any* challenge.

Only with indispensable bituminous
can the greatness of America be maintained.

For excellent bituminous coals
to meet your every need,
Ask our man!

BALTIMORE & OHIO RAILROAD

Constantly *doing things*—better!

LINKING 13 GREAT STATES WITH THE NATION
B&O

USE STRONG* STRAINERS -for *better* protection!

For steam, air, water and gas. STRONG'S new "Y" type strainer is ideal for the protection of steam traps, reducing valves, temperature controls, air control equipment, pumps, etc.

A HIGH-QUALITY, LOW-COST STRAINER!

★ **Monel Screen**—Mesh cloth in sizes ¼" to ⅜", larger sizes standard with .027 perforations. Self-centering guides prevent crushing.

★ **Semi-steel Body**—For rugged service. Sizes ¼" to 2". For steam pressures to 250 psi, cold pressures to 400 psi.

★ **Easy Installation**—New V-shaped gripping lugs on inlet and outlet bosses—may be easily installed with any type wrench.

CAST STEEL "Y" STRAINER

Available for pressures to 600 psi, screwed and flanged. Sizes ¼" to 4".

Send for Catalog 68-P today!

*Reg. Trade Mark

STRONG, CARLISLE & HAMMOND COMPANY

1392 West 3rd Street
Cleveland 13, Ohio

ANUM-METL Reg. Trade Mark

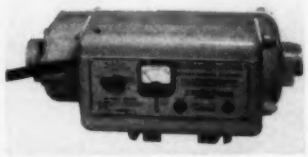
OTHER STRONG STEAM SPECIALTIES

No. 070 Small Trap | 80 Series Trap | "T" Type Strainer

STRONG

the hopper to the fire where coal burns on an air-cooled hearth from which ash is readily removed.
Iron Fireman Mfg Co, 3170 West 106th St, Cleveland, O.

For more data on these items, use post cards, p163. Identify request with P and number



BATTERY CHARGER FOR SHELF MOUNTING **P1032**

Motor-generator type battery charger, designed to permit mounting on balconies or shelves to save floor space. For charging batteries in driver-lead and small driver-ride industrial lift trucks, the new unit accommodates lead-acid batteries of 16-19 cells and nickel-iron-alkaline batteries of 10-30 cells. It is about the size of a tank-type vacuum cleaner with a control box mounted on its side, weighs only 190 lb, and can be installed on a shelf measuring 6¾x8¼ in.

Unit is fully automatic; it is only necessary to plug it in and set the timer; automatic controls do the rest. Voltage (based on number of battery cells) and current (based on ampere-hour battery ratings) are adjustable.

Incorporated in the design of the new unit are many features recommended by the Industrial Truck Association. Included are: automatic disconnection of charger from power line and opening of charging circuit in power interruption, automatic restart of charger upon resumption of power supply following an interruption, automatic control of charging rate under the modified constant-voltage charging system, and automatic cutoff of battery and shutdown of charger when battery is fully charged.

Single-circuit equipment operates on 3-phase, 60-cycle, ac power, and has generator-overload and motor-overload protection to guard against excessive currents.
General Electric Co, Schenectady 5, N. Y.

ELECTRICAL INSULATION **P1036**

Quinterra Type 3, an asbestos-base, silicone-treated, high-temperature electrical insulation is classified as Class H, for service at 180 C. Silicone-treated *Quinterra Type 3* is used for both inter-layer and wire wrapping insulation. It is adaptable to a wide range of electrical devices including air-cooled inert gas, and silicone-filled transformers. Some advantages it offers are savings on materials, a greater factor of safety and opportunity for more compact design.

This insulation maintains a dielectric

PITTSBURGH *
OMAHA
NEW ORLEANS
MINNEAPOLIS
WASHINGTON, D. C.
JACKSONVILLE
SALT LAKE CITY
ORANGEBURG, S. C.
PORTLAND, ORE.
CHICAGO
SAN FRANCISCO
ST. LOUIS
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WHEREVER YOUR LOCATION...

YOU ARE ALWAYS CLOSE TO CLEAVER-BROOKS FACTORY-AUTHORIZED SERVICE

CLEAVER-BROOKS steam boiler service facilities are national — to enable you to get the most in performance through proper care and maintenance of your boiler.

YOU GET...

Starting Service: Boilers are placed in operation by Cleaver-Brooks field representatives who check installation, operation, and make a complete and detailed Field Report to you and to Cleaver-Brooks.

Operation Manuals: Your operators are trained in care and operation by Cleaver-Brooks and furnished with comprehensive, easy-to-understand operation manuals.

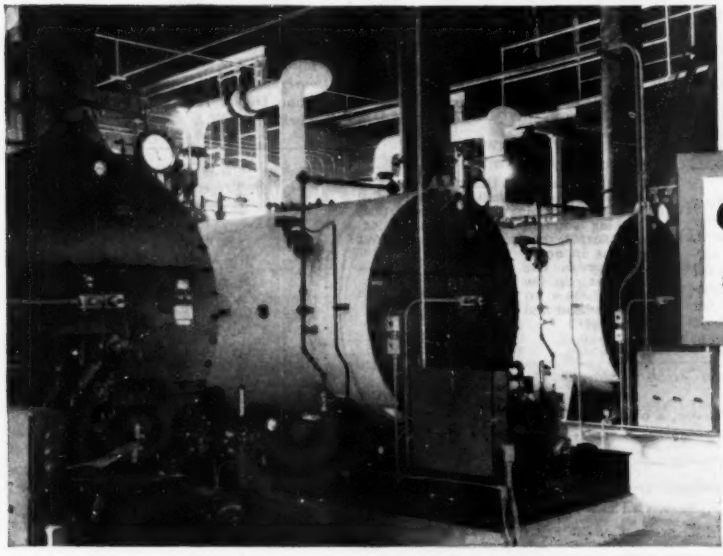
YOU HAVE READILY AVAILABLE

Parts: Cleaver-Brooks replacement parts are quickly available through field representatives, parts depots, and the factory.

YOU WILL FIND IT PAYS...

to equip with Cleaver-Brooks — steam boilers that operate at a guaranteed efficiency of 80% — burn gas, oil, or combination gas and oil — fully meet all codes — standard models available in sizes 15 to 500 hp.; 15 to 200 PSI.

**Just a few of the many Cleaver-Brooks authorized service centers*



Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler catalog.

Cleaver-Brooks
STEAM BOILERS
the first and finest of their class

CLEAVER-BROOKS COMPANY
301-K E. Keefe Ave., Milwaukee 12, Wis., U.S.A.
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Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

HERE'S WHY

TILCO-FIN CUTS THE COST OF HEAT TRANSFER AS NO OTHER FIN TUBING CAN!

EXCLUSIVE!

- *segmented fins*
- *fused metal shoulder*

MOVE TWICE AS MUCH HEAT*

per unit of surface as any other type of fin tubing!

See how much TILCO-FIN will save in your plant

SURE, fin tubing is the best way to handle most heat transfer operations. Cost data from dozens of industries prove it—over and over again.

The important thing is to get the *best* fin tubing.

Cost data and independent testing provide a positive answer here, too—TILCO-FIN!

Millions of feet of this cost-cutting tubing are in use today, *setting economy records* for waste heat steam generators, air-cooled jacket water exchanges, air-cooled condensers, air-cooled lube oil coolers, gas heaters and coolers, instrument enclosure heaters, blast coils for space heating and cooling.

You can get all of Tilco tubing's exclusive advantages on large jobs or small, a tailor-made installation that will *transfer twice as much heat per unit of surface!* The fused shoulder eliminates costly heat loss due to interfaces of dirt, air and corrosion common on other types of tubing. It's a rugged, welded fin bond that *will not break!*

Chemical and Power Engineers Valuable New Handbook FREE!

Get all the facts about this modern way to multiply your savings on heat transfer jobs. This newest fin tubing reference source puts everything you need to know about extended surface equipment right at your fingertips in accurate easy-to-use form. Just clip the coupon below to your letterhead and mail today!

12 page, file-size booklet. Tells you how to choose and use fin tubing to best advantage. Includes data tables, graphs, charts, nomograms.

*Proved in independent comparison tests by Norris and Spofford, Transactions of the ASME, July 1942

TILCO-FIN DIVISION, Kentile, Inc.
58 2nd Ave., Brooklyn 15, N. Y.

Please send me, without charge or obligation, a copy of the Tilco-Fin Tubing Handbook.

Name_____

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City_____ Zone_____ State_____

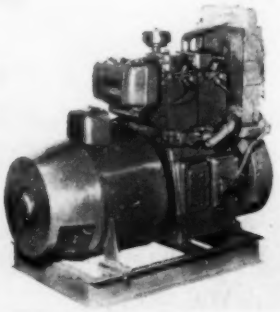
More EQUIPMENT NEWS

Begins on page 154

strength of at least 350 vpm under continuous exposure to Class H maximum temperature of 180 C. Furthermore, this dielectric strength remains practically constant even under continuously high humidity; *Quinterra Type 3* has high moisture resistance.

This insulation is supplied in sheets, rolls and tapes. Widths can vary from ¼ to 36 in., factory cut to specification. Available thicknesses are from 3 to 9 mils.

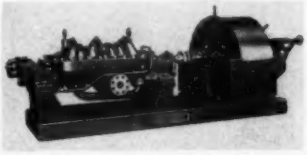
Johns-Manville, 22 East 40th St, New York 16, N. Y.



4-CYCLE DIESEL ENGINES P1022

Three watercooled and one air-cooled model are now available. Maximum power ratings of watercooled models: 3-15, 12-22.5 and 12-45 hp. Air-cooled model is rated at 3-12.5 hp, maximum. Engines are suitable for driving generators, pumps, refrigeration compressors, auxiliaries, etc. Units are 1-, 2-, 3- or 4-cylinder, depending on rating. Optional extra equipment includes radiator (for watercooled models in temperate or tropical climates), fan, guard, drive, watercooled manifold, overdrive gear, reverse rotation, clutch for half- or full-speed power takeoff, variable-speed governor, electric starting equipment, etc. **Aboe Diesel Inc, 350 Fifth Ave, New York 1, N. Y.**

For more data on these items, use post cards, p163. Identify request with P and number



MULTISTAGE PUMPS P1010

Four-, six- and eight-stage opposed impeller pumps are designed for general medium pressure and temperature services up to 1000 gpm at 1200 psi and 400 F. They are suited to boiler-feed, oil-refinery service for handling liquids ranging from propane to strong caustic and general water

IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS

TO MARK PROGRESS

...you get full value for every fittings dollar

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

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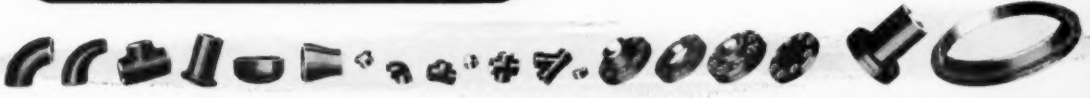
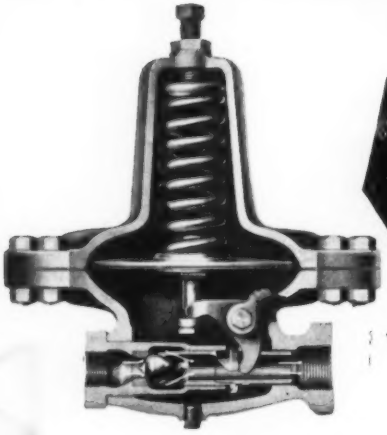
The more critically you appraise value... the more you will appreciate Ladish Controlled Quality Fittings. For the ultimate economy of Ladish Fittings is assured by laboratory, engineering and manufacturing controls unsurpassed for thoroughness and rigid standards. From metallurgy through machining ... repeated tests safeguard the extra strength and soundness vital to long dependable service ... extra value you can always depend on from Ladish Controlled Quality Fittings.



10 POINT *Results*

FROM

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE **REDUCING VALVES**



THESE TROUBLEMAKERS FIND NO OPPORTUNITY TO PERFORM WITH THE "1000" ON THE JOB

A MANUFACTURER CHECKS THE 10 POINTS AND SAYS . . .

"We have 3 of these '1000' valves and all of them are giving good service."

THE 10 POINTS ARE CHECKED BY A RESEARCH FOUNDATION, THEY SAY

"These valves have been VERY SATISFACTORY BOTH IN OPERATION and MAINTENANCE. The MAINTENANCE COST IS ABSOLUTELY NOTHING once this '1000' valve is installed. Wherever any one may need CONTROLLED PRESSURE IN EITHER STEAM, AIR, or ANYTHING—this CASH STANDARD '1000' valve can be relied upon to do just that and TO GIVE CONTINUED TROUBLE-FREE service."

A MEAT PACKER SAYS IN CHECKING THE 10 POINTS . . .

"Very little maintenance required."

A STEEL CASTING CO. CHECKS THE 10 POINTS—THEY SAY . . .

"We find your CASH STANDARD Streamlined Type '1000' Pressure Reducing Valves to be VERY RELIABLE. We have a number of these valves in service throughout our plant, and have NEVER HAD ONE OUT OF SERVICE for any reason. These '1000' valves have been in service for approximately five years."

A MOULDED PRODUCTS CO. CHECKS THE 10 POINTS AND SAYS

"Maintenance time and cost very low."

These are the Points
USERS CHECK WITH . . .

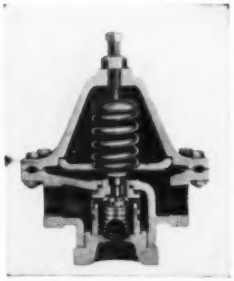
1. **Maximum capacity when needed most.**
2. **Accurate pressure control under toughest working conditions.**
3. **Trouble-free service.**
4. **Smooth operation.**
5. **Tight closure.**
6. **Speedier production results.**
7. **Elimination of failures.**
8. **Cost-saving operation.**
9. **No spoilage.**
10. **Practically zero in maintenance.**

WRITE FOR BULLETIN 962

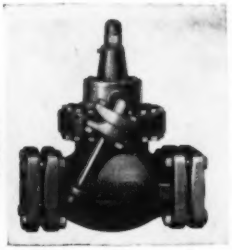
CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

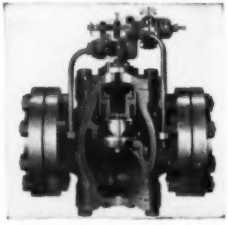
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES
Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.

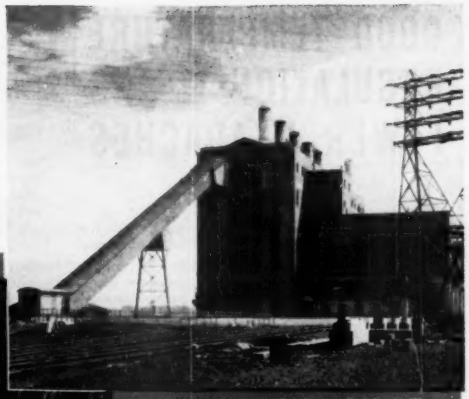


Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

To Safeguard Your Plant
COAL HANDLING MUST BE RIGHT
Buy Time-tested Units



This power station of a large Public Utility depends upon Jeffrey coal and ashes handling machinery for day-in and day-out service. They can take no chances. At left, a Jeffrey Belt Conveyor and below a Jeffrey Weigh Larry.

- Ash Handling Systems
- Belt Idlers
- Bin Valves
- Bucket Elevators
- Car Pullers
- Chains and Sprockets
- Crushers and Coke Sizers
- Conveyors — Apron, Belt, Drag, Pivoted Bucket, Spiral and V-Bucket types
- Drive Arrangements
- Feeders — Apron, Belt, Spiral Electric Vibrating
- Pulverizers
- Silo Storage Systems
- Skip Hoists
- Track Hoppers
- Transmission Machinery
- Weigh Larries

Breakdowns are costly . . . failure especially during peak-load periods can be just as disastrous as the failure of the power generating equipment. We know that coal handling machinery must be right . . . have hundreds of installations to prove it. Let Jeffrey safeguard your plant . . . there is an efficient system (or unit) for every type and size of plant. Also equipment for taking away the ashes. For greater efficiency and savings in cost . . . better see us.

THE JEFFREY MANUFACTURING COMPANY

ESTABLISHED 1877

922 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

Boston 16 · Cincinnati 2 · Detroit 13 · Houston 2 · New York 7 · Pittsburgh 22

Jeffrey Mfg. Co. Ltd., Montreal, Canada

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Galion (Great Britain Ltd.) Wakefield, England

The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio

GOOD TEMPERATURE REGULATION MEANS FEWER HEADACHES

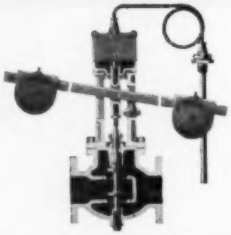
In Power Plants all over the world, you will find Foster Temperature Regulators controlling temperatures of liquids and gases on heating and cooling equipment such as fuel-oil heaters; storage type water heaters, evaporators and cooling systems. The reason for this acceptance is that they offer a simple, dependable answer to accurate, automatic temperature control. They do their job well, with a minimum of maintenance.

The Foster line of Temperature Regulators is also good news for plants where ovens, dryers, cookers, coolers, pasteurizers and similar types of equipment are extensively used. By controlling temperatures accurately, they help the uniformity of materials in process and often save fuel. They can be furnished with casing wells so that thermal units can be replaced without lowering liquid level of vessel.

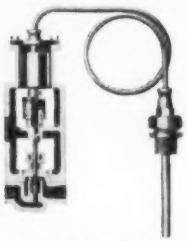
Foster Engineers are competent to work with you to get the right type of regulator for your own specific needs.

Here are 4 typical Temperature Regulators in the Foster Line of more than 8 standard types.

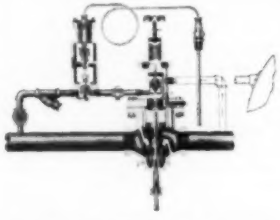
The Foster Type 34-T controls temperatures within approximately 1° F plus or minus, using steam or gases as heating medium. Internally pilot-operated, diaphragm actuated; valve travels from shut-off to full opening with relatively small temperature change.



The Foster Type T-3 controls temperatures within 3° to 5° F, plus or minus, using steam, water or other liquids and gases as heating or cooling medium. Handles large volumes with low pressure drop across double seats.



The Foster Type T-4 controls temperatures within plus or minus 5° F, using small volumes of steam, water or other liquids or gases as heating or cooling medium. Direct-acting, single seated for tight shut-off.



The Foster Type T-10 combination temperature and pressure regulator permits safe use of steam at pressures considerably higher than the shell of the heated vessel is built to withstand. Adjustable for both temperature and pressure.

[illegible]

FOSTER ENGINEERING Company

825 Lehigh Avenue • Union, N. J.

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . CUSHION CHECK VALVES . . . ALTITUDE VALVES . . . FAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN VALVES . . . VACUUM REGULATORS OR BREAKERS . . . STRAINERS . . . SIRENS . . . SAFETY VALVES . . . FLOW TUBES

More EQUIPMENT NEWS

Begins on page 154

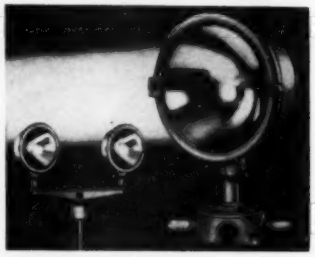
service, descaling, hydraulic and mine drainage.

Pumps have a horizontally split casing with suction and discharge nozzles on opposite sides of the lower half of the casing. Impellers are mounted back to back to balance axial thrust and the volutes are staggered 180 deg to balance radial thrust.

Bolted-in stuffing boxes permit using a plain box with lantern ring for suction lifts; a watercooled box for high temperature and high suction pressure; single or double mechanical seals or a breakdown bushing and leakoff.

De Laval Steam Turbine Co, Trenton 2, N. J.

For more data on these items, use post cards, p163. Identify request with P and number.

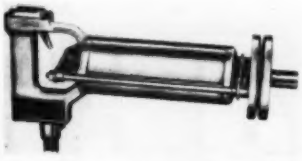


OUTDOOR SPOTLIGHT P1033

Spotlight providing 100,000 cp with a 300-watt rating. Unit is designed to concentrate its entire light output in a long-throw, oval-shaped, narrow floodlighting beam suitable for area protection lighting of railway sidings, switch and loading areas, shipyards, docks, air terminals and other industrial properties.

Made of noncorrosive, heavy-duty cast aluminum throughout, Stonco No. 56 spotlight has a universally adjustable cast-aluminum ½-in. threaded swivel arm. Up to five units can be mounted to a single cluster light assembly so in anti-sabotage lighting in particular, all lights in a cluster have to go out before total darkness is possible.

Stonco Electric Products Co, 489 Henry St, Elizabeth 4, N. J.



ELECTRIC HAMMER-DRILL P1034

Electromagnetic hammer-drill, Model No. 17-RO, for high-speed drilling in concrete, brick and stone. The No. 17-RO has a 1⅛-in. drilling capacity, weighs 21½ lb, and is available for operation from 110- or 220-v ac.

Automatic rotation of carbide-tipped,

Boilers at Bendix-Westinghouse

Protected with

DREW

COMPLETE BOILER WATER TREATMENT

The Bendix-Westinghouse plant at Elyria, Ohio, is a show place of modern industry. Its facilities, from production machinery to power plant equipment, are new and modern—everything reflecting the company's slogan: "The Best Brake is Air—The Best Air Brake is Bendix-Westinghouse."

Modern boiler water treatment and corrosion control play an important part in this plant, too. The boilers, operating at 400 psi., are protected by Drew Complete Boiler Water Treatment. The steam and condensate return lines are protected by Drew Steam Line Corrosion Control. Better power plant operation is assured by the Drew 3-point program:

1. Drew engineers make thorough studies of boiler plant operations and water conditions.
2. Drew water chemists and engineers analyze this data in Drew laboratories and make specific recommendations for treatment.
3. Drew engineers make frequent tests in the plant to assure efficient performance of the water conditioning.

Thoroughness of investigation, proper treatment and frequent service have made Drew one of America's fastest growing water treatment companies. Industry's most respected names avail themselves of Drew Boiler Water Treatment and Service. Do the same. Consult the nearest Drew engineer or write for information.

Send for new illustrated DREW ORGANICS folder describing the use of organics in modern boiler water treatment. Write today.

POWER DREW CHEMICALS

Power Chemicals Division

E. F. DREW & CO., INC.

15 East 26th Street, New York 10, N. Y.

Nationwide Service in Boiler Water and Cooling Water Conditioning

DREW PRODUCTS

You Get Longer Service, Less Maintenance, Greater All-Around Dependability with

GOLDEN-ANDERSON

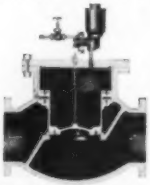
Cushioned

Steam and Water Pressure Valves

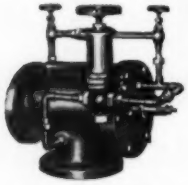
One of these eight valves will ideally meet your requirements

Single-Acting Non-Return Valve

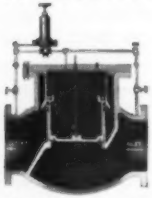
Altitude Control Valve



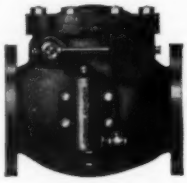
Solenoid Operated Electric Water Service Valve



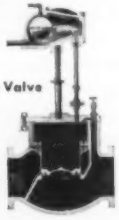
Surge Relief Valve



Water Pressure Reducing Valve



Swing Check Valve



Cold Water Float Valve

Triple-Acting Non-Return Valve

Our descriptive bulletins covering these various valves gladly sent on request.

GOLDEN ANDERSON Valve Specialty Company

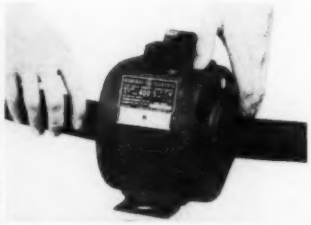
2070 KEENAN BUILDING • PITTSBURGH 22, PA.

More EQUIPMENT NEWS

Begins on page 154

spiral-fluted drill speeds up hole drilling, eliminates manual turning of drill chuck and reduces fatigue. A powerful hammer in maintenance and installation for quantity hole drilling, installing machinery or hanging heavy pipes and ducts.
Syntron Co, 492 Lexington Ave, Homer City, Pa.

For more data on these items, use post cards, p163. Identify request with P and number



CURRENT TRANSFORMERS P1038

Line of butyl-molded 600-v transformers can be used on single-phase and on polyphase circuits indoor and outdoor. Butyl insulation combines low moisture absorption, good corona and sunlight resistance, excellent adhesion to copper, very low power factor, and good resistance to mechanical damage. By using butyl, expensive porcelain and metal cases are eliminated, and the molded insulation permits compact designs meeting standard mounting dimensions for indoor applications.

First of the new line is Type JKP-O, a 600-volt window-type current transformer with primary ratings of 200-, 400-, and 600-amp. It is designed to carry 200% of rated primary current continuously.
General Electric Co, Schenectady 5, N. Y.

SURFACE HARDENING P1024

Quick, safe, surface hardening by an ordinary welding torch can be carried out with two new compounds, *Instant Hardener, No. 1 and No. 2*. All that need be done is to heat evenly the metal to be hardened with a welding torch. Dip into a container of the hardening compound. Withdraw and reheat. Then quench. No. 2 hardener is strengthened with small, hard facing particles mixed right into the compound.
Eutectic Welding Alloys Corp, 40-40 172 St, Flushing, N. Y.

WELDING ELECTRODE P1002

Relatively inexpensive, hard-overlay electrode *EuteChrom 2X* for ac-dc arc welding has a *FrigidArc* flux coating. It deposits a strong, dense overlay, said to have good corrosion resistance. By laying the deposit down at lower amperages dangers of distortion and stress are reduced. It is recommended for carbon and alloy steel surfaces subject to severe abrasive wear and

and then...?

After they leave the drawing board, your plans for critical power-plant piping depend on the integrity and experience of the men who will carry them through. For more than half a century, the nation's leading designers of power plants have depended on our specialists to meet the most rigid specifications. Hundreds of installations involving extremes of pressure and temperature are evidence of our ability to deliver.

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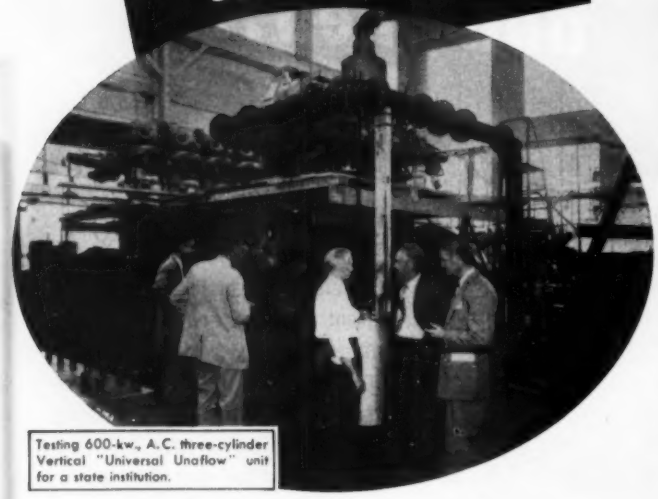

Testing 600-kw., A.C. three-cylinder Vertical "Universal Unaflow" unit for a state institution.

2500 individual economy load tests have been conducted on Skinner "Universal Unaflow" Engines. Such tests are made, under working conditions, either in the Skinner plant to prove performance in advance of operation, or after installation by the purchaser. In other cases, tests are made for our own information, to determine what effect certain changes in design may have produced in the engine's economy. Sixty-three tests have been run during the first six months of 1951.

Many of the 2500 tests have been acceptance tests . . . tests made with penalty for failure to prove steam economies guaranteed in the sales contract . . . *and no engine has ever failed to make good.*

These gruelling tests are one of the chief reasons for the initial and maintained high economy of Skinner "Universal Unaflow" Engines. Correctly designed for a high degree of efficiency, every part is made of material carefully chosen for the function it must perform, and precision-fitted for long life and smooth, trouble-free performance.

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More EQUIPMENT NEWS

Begins on page 154

comparatively mild impact. Available in 1/8, 5/32, 1/4 and 3/16 in. dia.
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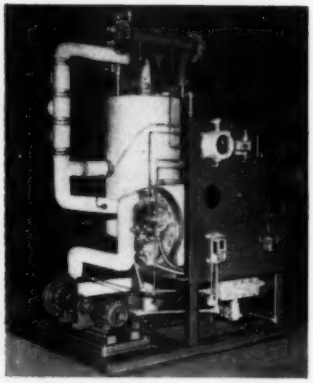
For more data on these items, use post cards, p163. Identify request with P and number



LIQUID HEATER **P1080**

Standard line of electrically heated *Dowtherm* heat-transfer units cover a range of capacities from 100,000 to 500,000 Btu per hr with temperature range to about 750 F. They use *Dowtherm* as a liquid or vapor medium. But other heat-transfer fluids may be used. Entire assembly can be base-mounted at the factory, or supplied with all essential equipment for field mounting.
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BELT CLEANER **P1006**

Self-aligning, spring-steel wiper blade, set perpendicular to the conveyor belt surface but diagonal to belt travel, wipes belt clean and dry as it passes. Spring arms supporting the blade maintain a uniform pressure on belt and allow the blade to ride easily over belt obstructions like splices. Dribble from the cleaner falls directly to the rear of the discharge chute at the head end of the conveyor.
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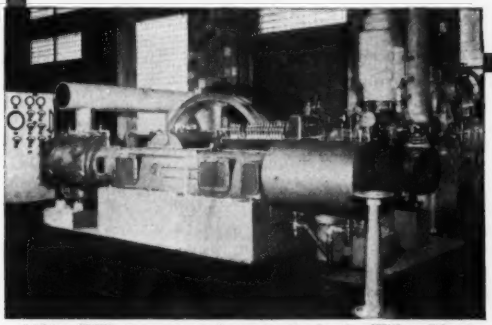
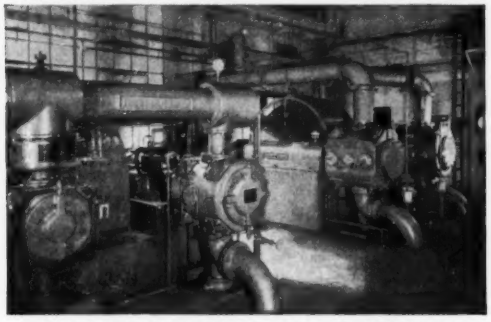
LOW-TEMPERATURE COOLER **P1020**

Seven models of these low-temperature unit coolers using ammonia refrigerant and seven similar models using Freon are in production. Units are for applications needing below freezing temperatures like frozen-food storage, fur storage, meat packing, ice-cream plants, etc. Coolers are compact, may be used in multiple for greater capacity and provide rapid defrosting by water spray.
York Corp, York, Pa.

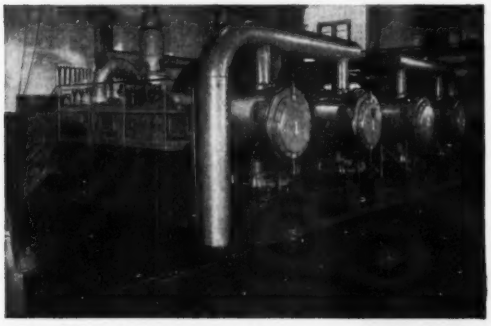
American Cyanamid Company *needs* and *buys* Dependable Equipment



235-hp XPV steam-powered compressor in the Willow Island powerhouse supplies air for plant processing operation, plant process-control instruments, and powerhouse combustion-control instruments.



These two XRE electric-driven compressors in the Bridgeville, Penna. plant supply air for reactors, and for control instruments.



Two 366-hp XPV steam-powered compressors in the Bound Brook, N. J. plant supply air for general plant service.

I-R Compressors, Pumps, and Ejectors are in All Plants

● American Cyanamid Company produces a great number of chemical and pharmaceutical products in its many plants. In the manufacture of products such as aureomycin, all processes must be well co-ordinated. And dependability of the associated equipment is essential for the dependability of the manufactured product.

Ingersoll-Rand equipment plays an important part in such processes as the production of aureomycin. Here are some of the I-R products used on this, and other applications:

Calco Chemical Plant, Bound Brook, N. J.

Three XPV steam-powered compressors on plant air service, two heavy-duty ammonia compressors, ten ALV river-water pumps, and several portable compressors.

Lederle Laboratories Plant, Pearl River, N. Y.

Two large electric-driven compressors supplying air required on a fermentation process for aureomycin production, several condenser coolant pumps for the same process, and four steam-jet ejectors also on aureomycin process work.

Warners, N. Y., Plant

Steam-jet ejectors on process work, PRE and XRE electric-driven compressors on general plant service, and several boiler-feed pumps.

Bridgeville, Penna., Plant

Two XRE electric-driven compressors supplying air for reactors, and also for process control instruments in the plant and combustion control instruments in the powerhouse.

In other American Cyanamid plants there are more examples of reliable I-R machinery, each machine giving the dependability that is needed. Ask I-R engineers to show *you* how to buy dependability.

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This Type B — Boiler By Bigelow being installed was shipped completely assembled. It has a capacity of 20,000 lbs. steam per hr. continuous, 25,000 lbs. steam per hr. peak loads. The boiler is 10'7" wide, 21'9" long, 15'10" high and has 3,287 square feet of heating surface.

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More TECHNICAL BRIEFS

Begins on page 150

cated that many equipment failures were of a nature that would require a unit outage regardless of the number of supervising and operating men available. So it appeared statistically that few additional shutdowns would result if the operating force were cut down to a minimum. In fact, freedom from operating errors might overcome any disadvantage resulting from fewer people in a plant. This thinking is reflected in design in which large boiler feed pumps and other major auxiliaries are started with no one standing by the equipment and in the total elimination of steam-driven auxiliaries.

For true remote operation, it should be possible to run a boiler, bring a turbine from standstill to full load, and then shut down the unit, without any occasion to leave the control room. Several units now in service are giving such operation, and still further refinements are contemplated for plants now in the design stage.

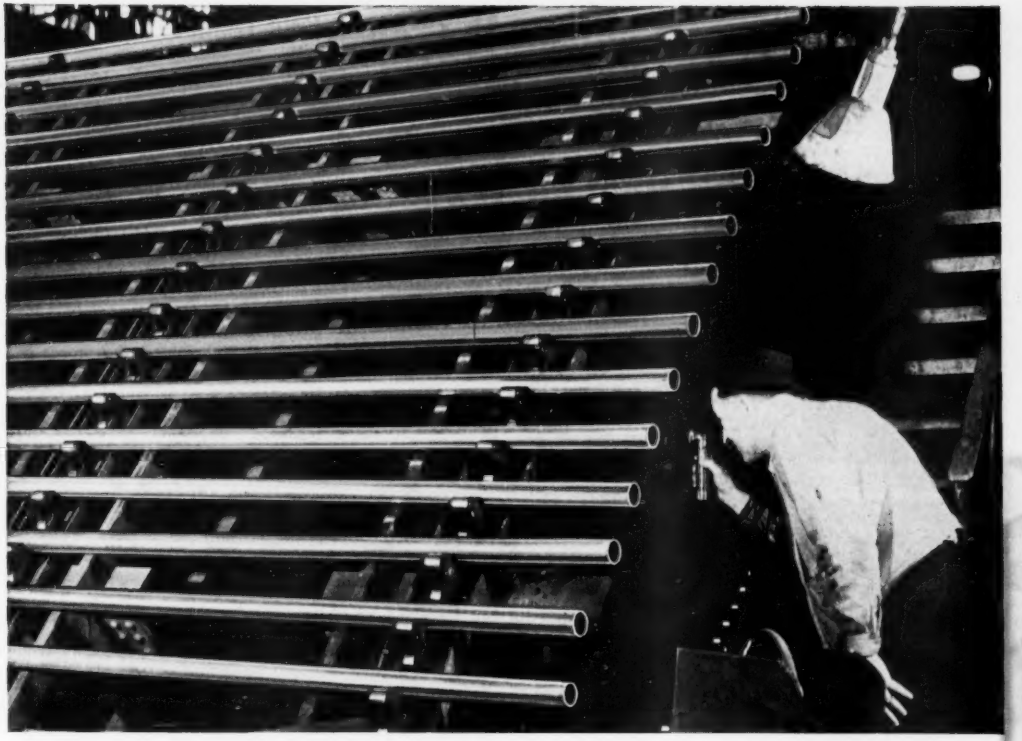
But first a survey must be made to cover the various operating situations that may arise, and then careful thought should be given to the way they will be handled. Some items to consider are: (1) accidental tripping of the generator (2) loss of vacuum (3) boiler-tube failure (4) loss of ignition.

At the same time starting method, dropping and handling major load changes require rather special attention. So correct action for such conditions follows one of these classifications: (1) those about which the boiler operator can do nothing, such as a tube failure (2) those in which corrective action can be postponed for some time, such as partial plugging of a service water strainer, or closing of certain valves during startup (3) those to which automatic control can be applied, such as pulverizer output temperature control and certain automatic bypasses (4) those, like ignition loss, requiring immediate and intelligently directed efforts of the operator.

In the systems described, each control room has been designed to segregate the various operating details. This is done so, if trouble develops in one section, the operator may devote full attention to this area while the remainder functions a short time without supervision. *ASME paper No. 51-SA-47.*

Directions for ordering papers on p 152

Centralized Control of Steam Electric Generating Stations. *By M D Engle and H F Hatfield, Pennsylvania Power & Light Co.*



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Hundreds of power plants and refineries have found chlorination by W&T the answer to heat exchanger slime problems. By eliminating slime forming microorganisms, maximum heat transfer is maintained in the condensers. The result — overall plant efficiency is kept at a maximum.

REDUCE LABOR COSTS . . .

High labor costs involved in frequent condenser tube cleaning are eliminated when chlorination is employed. Man-hours used for tube cleaning can be utilized for other maintenance jobs, an important factor with the increasing manpower shortage.

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Elimination of frequent shut-down for tube cleaning helps power plants stay continuously "on the line." When chlorination is employed, many plants find that outage for cleaning is reduced to once per year and then only for removing trash from tube sheets.

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More TECHNICAL BRIEFS

Begins on page 150

One of the important considerations in deciding on centralized control for a power plant is a knowledge of the requirements of your principal control room. These requirements, as the authors see them, are that they be large enough without undue crowding of either the front or rear control panels and with enough space between equipment to permit proper and economic maintenance and calibration. Further, there should be enough recording and indicating instruments and annunciators along with controls for proper information. In addition, good and regular emergency communication systems to all parts of the station should be available. Important provisions for control rooms are (1) proper and adequate nonglare illumination instrument boards (2) shock-mountings (3) noise level low to reduce fatigue and permit conversation between operators over the several communication systems (4) complete air conditioning for comfort of operators and protection of the many delicate mechanisms in the instruments and controls.

At this time, there does not seem to be a valid reason, to the authors' way of thinking, to reduce size of gages and recording instruments to those normally provided in the cockpit of an airplane. But pilot lights and alarms should be provided so noncontinuous operation and abnormal conditions requiring operating judgment can be properly evaluated. Recording instruments give the operator a past record and free him from considerable log reading detail.

For the time being, these authors feel it wise to confine centralized control to major equipment and auxiliaries, such as turbine-generators, condensers, steam-generating units, cooling water, house service, makeup, boiler feed pumps, evaporators, air compressors, motor-operated valves, auxiliaries and electric power supply.

They feel it wise to leave for later attention the problem of bringing into the main control room data on coal-handling equipment, ash- and dust-handling equipment, dust separators, or the water-treatment plant. *ASME paper No. 51-SA-42.*

Directions for ordering papers on p 152

Modern Methods and Equipment for Control of Steam Generators. *By P S Dickey, Bailey Meter Co.*

Higher ratings on major units and auxiliaries and increasing pressures and temperatures require better and more complete instruments on automatic con-

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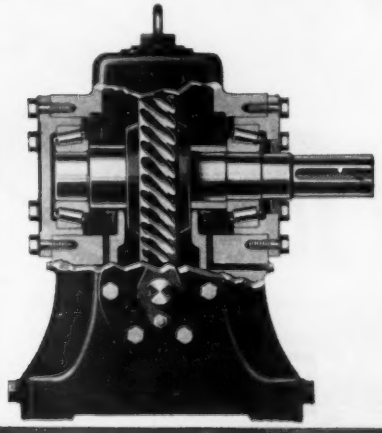

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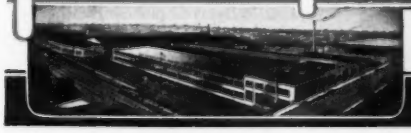

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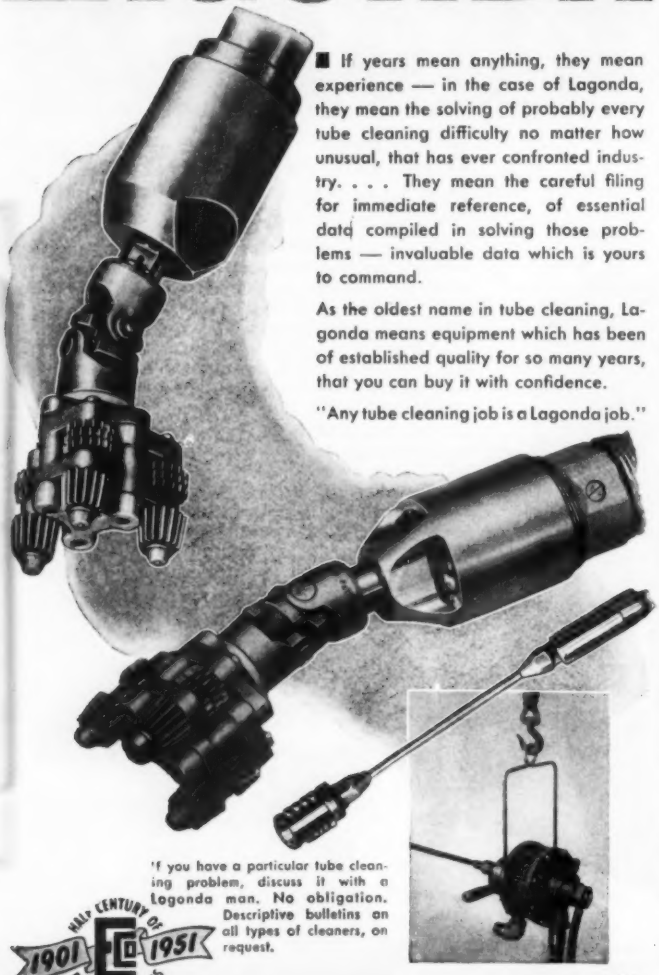

■ If years mean anything, they mean experience — in the case of Lagonda, they mean the solving of probably every tube cleaning difficulty no matter how unusual, that has ever confronted industry. . . . They mean the careful filing for immediate reference, of essential data compiled in solving those problems — invaluable data which is yours to command.

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More TECHNICAL BRIEFS

Begins on page 150

trol systems for safe and efficient operation. As the allowable limits are narrowed in the fields of temperatures, supervisory control must be improved. When you realize that responsibility for proper operation of a unit capable of generating 150,000 kw involves equipment costing from $20 to 30 million and capable of consuming 60 tons of coal per hour, it is imperative that the supervisors be given every possible mechanical aid.

The major job is to present a concise picture of all important operating conditions within a limited space. All these instruments and supervisory controls have to be arranged according to their basic function so during periods of stress the operators may move with the greatest efficiency and freedom from operating errors.

A study of supervisory control stations for a number of plants indicates that complete supervision of the larger boiler and turbine units requires three hundred or more points of measurement and control. By properly grouping gages and arranging scale ranges, a pattern can be developed so under normal operating conditions all pointers are in a line, or form an easily interpreted pattern. In this way, the operator reads all instruments at a glance instead of attempting to read each gage separately. By such a method he need only look for indications that do not follow the pointer pattern. *ASME paper No. 51-SA-40.*

Directions for ordering papers on p 152

Supervisory Instruments for Power-Generating Equipment. *By E Y Stewart and J H Reynolds Jr, General Electric Co.*

Equipment is now available to record turbine conditions in terms of shell and differential expansion, speed and camshaft position, bearing vibration, and shaft eccentricity. A description of shell and differential expansion recording equipment is a part of this paper. Another feature is the discussion of a number of case examples where mechanical trouble in a turbine or generator was detected by instruments.

Speed and camshaft position-recording equipment shows speed and starting up and shutting down, and also gives a measure of the load the machine is carrying in terms of percent rotation of the camshaft. This instrument is valuable in analyzing events that take place when the line breaker of the generator opens because of system disturbances.

The bearing vibration-recording in-

"Tycol Aturbrio never lets you down... turbines run for years without trouble"

How true! Tycol Aturbrio Oils are "double inhibited" to prevent oxidation and rusting. They provide maximum resistance to emulsification . . . permit continuous operation without sludge formation — performing for years without an oil change, completely eliminating, in many cases, down-time-high-cost maintenance.

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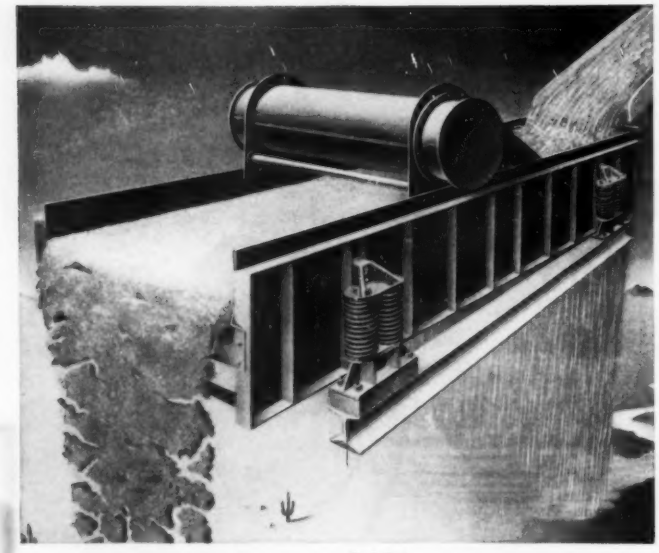

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If dewatering bulk materials is vital to your production . . . if inadequate removal of surface moisture affects product quality, output or economy . . . it will be worth while to explore the space- and labor-saving advantages of the Hewitt-Robins Eliptex Dewaterizer.

Hewitt-Robins has long been a pioneer in the development of vibrating machinery for dewatering, sizing, purifying and shaking out bulk materials—and for salvaging fines from waste. If any of these problems are *yours*, we invite you to make them *ours*.

*U. S. Patents 2,200,724 & 2,457,918

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More TECHNICAL BRIEFS

Begins on page 150

struments detect the amount of vibration on each of the main bearings of the turbine-generator in sequence. High-vibration changes are noted instantly. In addition, gradual long-time changes in vibration due to misalignment or other difficulties become a matter of record.

The shaft - eccentricity - recording equipment carries a running record at the rate of one revolution of shaft bow. This material is extremely helpful in detecting a loose thrust sleeve or runner that would not otherwise be detected by any other means until actual failure occurs.

A complete set of turbine supervisory instruments are valuable since only a study of all records made by the recorder will give an over-all picture of the operating characteristics of the turbine-generator at any time. Since the records for a particular machine are peculiar to that unit, normal operating records and records of unusual conditions in the machine should be used by the operators as a guide in operating, detecting unusual conditions, and in training operating personnel. *ASME Paper No. 51-SA-49.*

MARMADUKE

Continued from page 142

Marmy put down his glass, leisurely shoved his bowler four degrees to starboard, hooked his fists into the armpits of his checked vest—then blasted away. What could we do but listen.

"Back in 1908, I was chief maintenance engineer of a power plant down in Atlanta, Ga.," he roared. "Our equipment was modern for those times and we had a gang of watch engineers and maintenance men.

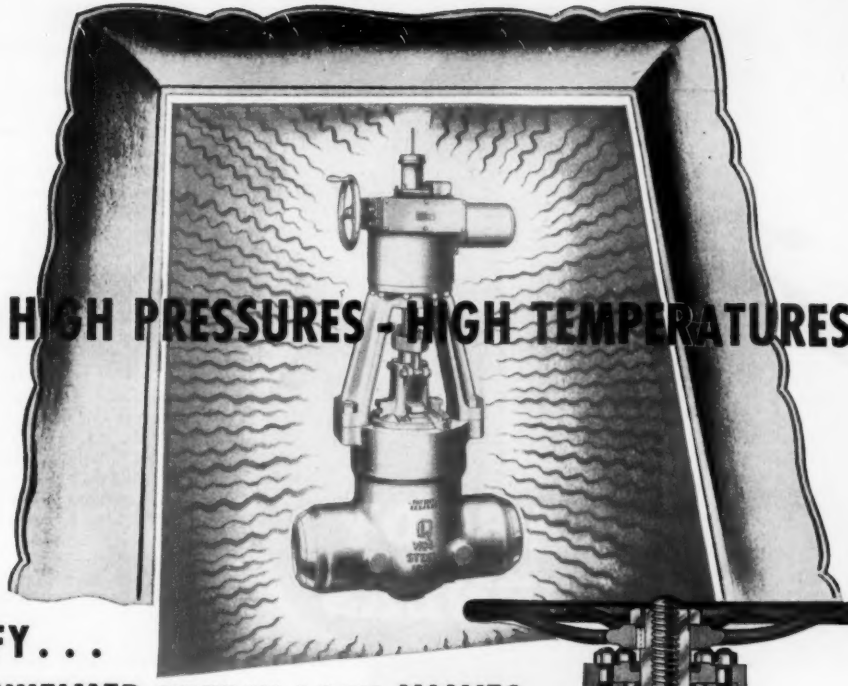
"In those days an engineer took pride in his job. And the management wouldn't tolerate a plant that wasn't all spit and polish. If there was so much as a blob of oil or speck of dust on anything in the big power-generation room, someone would hear about it.

"One day a bright-looking chap came into my office. Said he was an operating engineer with ten years' experience on corliss engines and high-pressure boilers."

" 'What kind of people do you have here?' he asked, first thing. That took me by surprise. I was supposed to ask the questions.

" 'How was your last plant?' I shot back.

" 'That's why I'm looking for a new job,' he answered. 'The plant was a good one and the machinery was in



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- The intermeshing lugs in body and bonnet carry full internal pressures, distribute stress evenly.
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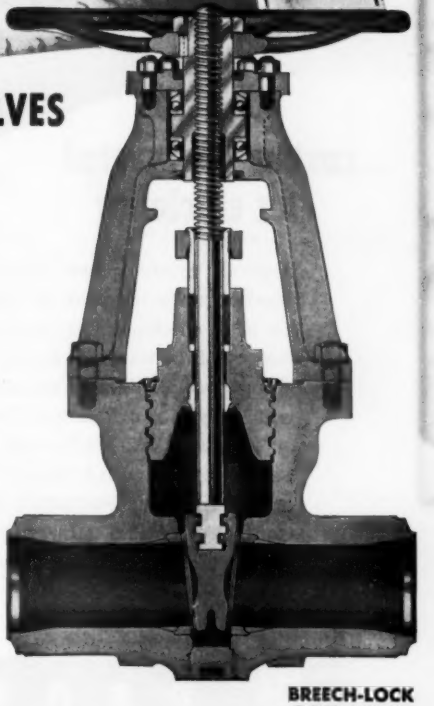
Meet the trend in your own plants by standardizing on Lunkenheimer Breech-Lock Valves — value-proved for fifteen years. *And write today for your copy of "Lunkenheimer Cast Steels," an informative brochure on high-temperature, high-pressure alloys. Address: The Lunkenheimer Co., Box 360A, Cincinnati 14, Ohio.*



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MARMADUKE

Continued from page 196

good shape, but the employes were a lot of sneaky so-and-so's.'

"'How come?' I asked, giving him plenty of rope.

"'Well,' he said, 'The chief engineer went around raising hell if you pulled the least kind of boner. Then the assistant chief had a habit of trying to foul my watch. One day I caught him loosening packing glands just to get me in dutch.

"'Then there was the maintenance foreman,' he raved on, crying the blues. 'He was the crookedest guy on two legs. He always charged against my watch breakdown repair jobs that happened on other watches.'

"'But that fireroom foreman was the payoff. That guy borrowed my tobacco, tools and money. And he never brought back anything without an argument. Boy, I hope I never see another plant like that,' he wound up, getting hot under the collar.

"'You don't want to work here,' I told him when he got through belly-aching.

"'Why?' he asked, surprised like.

"'Because,' I answered, 'you'll find exactly the same kind of people here. They're not only as bad,' I added, 'but chances are you'd find them much worse.'

"He buttoned up and went out of there with a dumb look on his face.

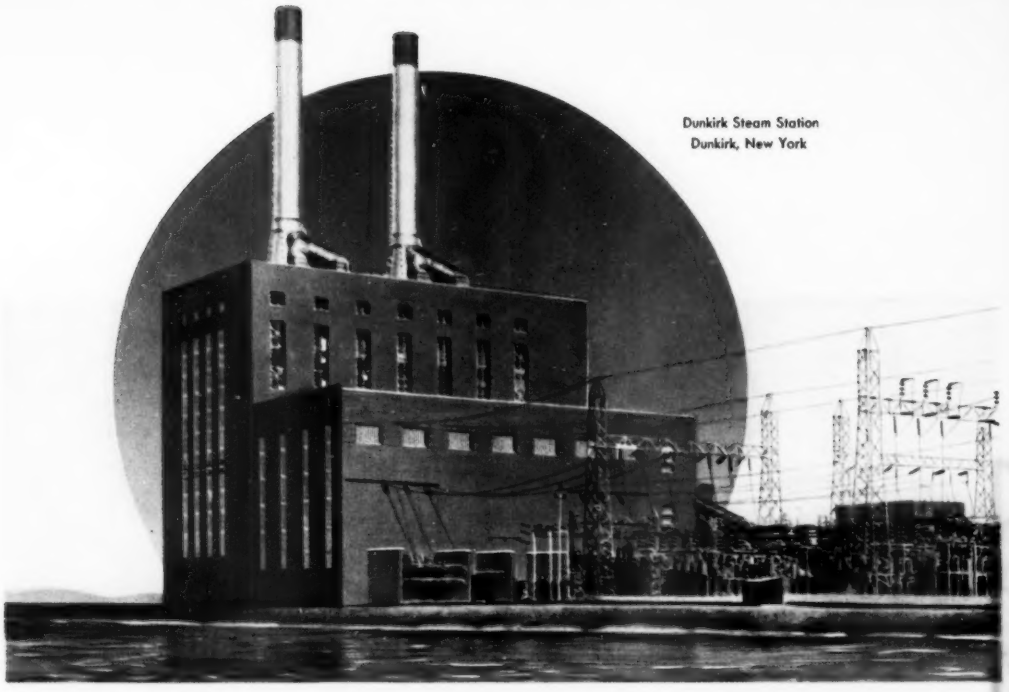
"A few months later another guy came in to see me about a job. He didn't look too sharp, but his face was honest. Said he was an operating engineer from up in Cincinnati. His wife's folks were from Atlanta and he wanted to settle here for her sake.

"'You sure have a fine plant,' he commented, craning his neck toward the machinery. 'I'll bet you have some mighty nice folks working here.'

"'How was your Cincinnati plant?' I shot back.

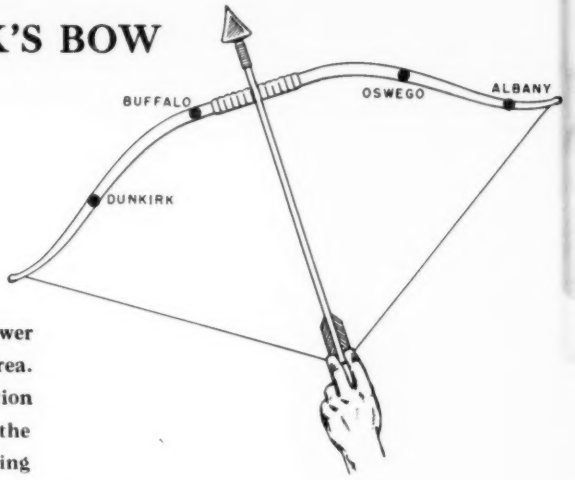
"'Well,' he began, 'I've worked in a lot of places, but that powerhouse had some of the finest people I ever met. The chief was a little quick on the trigger at times, but he meant well. And the assistant chief would give you the shirt off his back. If you were in a tough spot, he dropped everything and gave you a hand.'

"'The maintenance foreman was the payoff,' he continued, his face lighting up like a 100-watt bulb. 'He even came out to my place and helped me build a back porch onto my house one Sunday. He just couldn't do enough for people. And the eight-to-four watch engineer never got tired answering questions to help me get acquainted with the



Dunkirk Steam Station
Dunkirk, New York

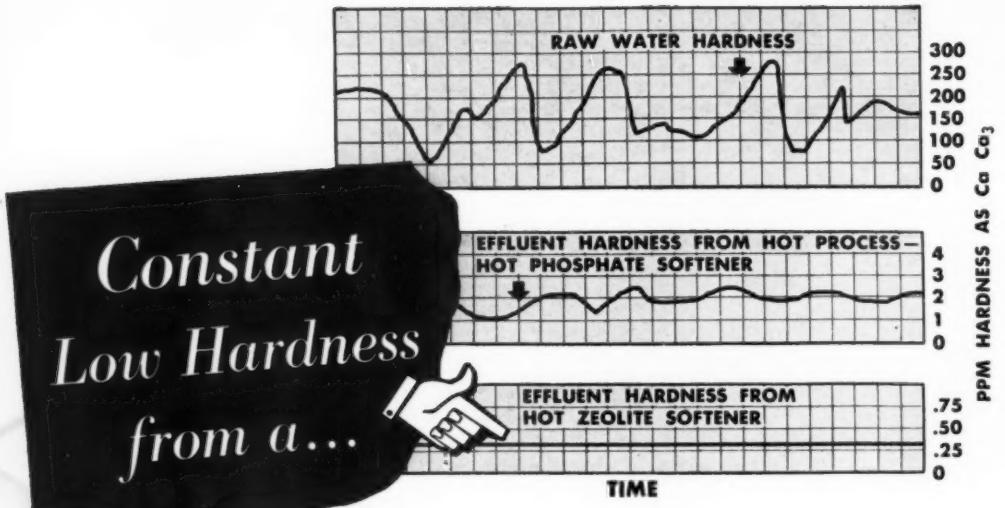
MORE POWER FOR NIAGARA MOHAWK'S BOW



The new Dunkirk Steam Station adds 160,000 kw of thermal generating capacity to the western end of the Niagara Mohawk Power Corporation system. This is an important step in the expansion program planned to satisfy the rapidly increasing industrial power demand in the Upper New York State area. Stone & Webster Engineering Corporation was the supervisor of construction of the station which was designed by the engineering staff of Niagara Mohawk.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY of STONE & WEBSTER, INC.



Constant Low Hardness from a...

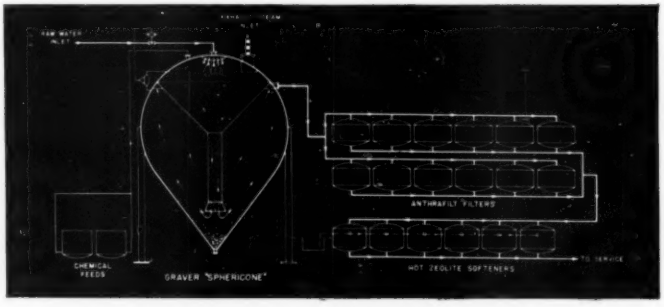
...Graver Hot Process Hot Zeolite Softener

Conventional lime-soda-phosphate hot process softeners effectively reduce raw water hardness. However, with extremely variable raw water supplies, chemical feeds must be adjusted to furnish precise quantities of chemicals in relation to raw water hardness and alkalinity in order to obtain suitable low hardness at all times.

The recent development of high-temperature resistant zeolites has provided a convenient solution to this problem. Substituting a second-stage hot-zeolite treatment, with Gravex styrene-base resin zeolite, instead of the more costly phosphate after-treatment, *constantly* low-hardness water is obtained *regardless* of sudden fluctuations in the initial hardness of the raw water . . . and at *lower cost.*

Therefore, if your raw water varies in source or hardness, be sure to investigate the Graver Hot Process — Hot Zeolite Softener. Graver engineers are available to discuss this process with you and compare its advantages over other processes at no obligation to you whatsoever.

Write for reprint of informative article on the features and benefits of hot zeolite softening.



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Division of Graver Tank & Mfg. Co., Inc.

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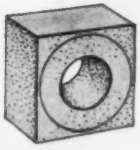
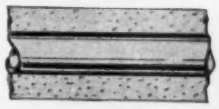
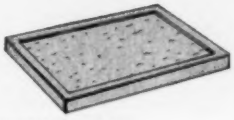
We're finding new uses every day for versatile **KAOCAST**



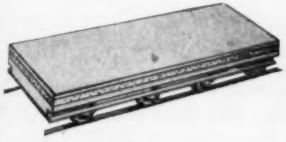
KAOCAST Burner Blocks



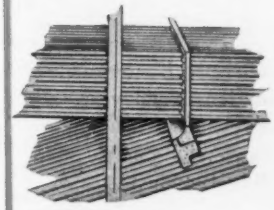
KAOCAST Covering for Water Cooled Furnace Tubes



KAOCAST Door Lining



KAOCAST Car Top



KAOCAST Boiler Baffles

Even our Field Engineers are surprised to discover the amazing variety of uses for versatile Kaocast. This unique 3000 degree refractory castable has been put to work in scores of imaginative applications where it has paid off in lower installation costs, faster repairs, longer service life. Here are a few examples:

- **Kaocast replaced firebrick in door linings... lasted 3 to 6 times as long, cut costs in half.**
- **In a tunnel kiln, ordinary castables used for covering car tops crumbled after a few trips. Kaocast stayed on the job for 30 trips without deterioration.**
- **Versatile Kaocast proved "better than anything previously used" for piers of a stoker-fired boiler.**
- **This jack-of-all-refractories performs so well that one central station keeps a large stock on hand for miscellaneous jobs.**

Are you missing a money-saving opportunity to use versatile Kaocast? Ask your B&W Field Engineer to give you additional facts and figures . . . to help you profit with Kaocast. • KAOCAST is another important refractories development by B&W engineers who have continuously established new standards in industrial furnace refractories for the past 30 years.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
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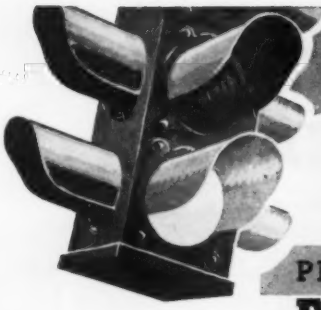
R-401

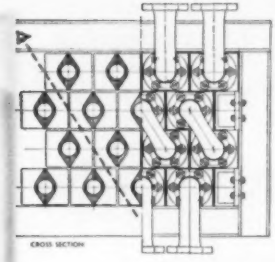
B&W REFRACTORIES PRODUCTS—B&W Allmul Firebrick • B&W 80 Firebrick • B&W Junior Firebrick • B&W Insulating Firebrick B&W Refractory Castables, Plastics and Mortars • OTHER B&W PRODUCTS—Stationary & Marine Boilers and Component Equipment... Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers . . . Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings



GREEN

PREMIER DIAMOND ECONOMIZERS

The Economizer with the "Diamond" Design



Here are the four major values in the "diamond" shape of the Green Fuel Economizer:

1... Streamline flow of flue gases gives minimum draft loss

2... Finned tubes give maximum heating surface in given space

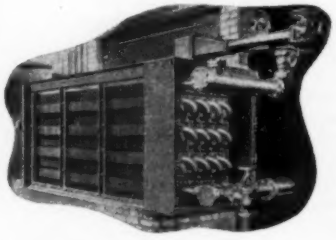
3... Staggered tube arrangement permits easy inspection

4... Minimum soot collecting surface is thoroughly cleaned by Green's "Special" Soot Blowers

Green Premier Diamond Economizers are available in either cast iron tube construction (Type 25) or steel tube construction (Type 12).

Pressure parts are rugged and joint flanges independent of support flanges.

Green Fuel Economizer's reputation of 60 years assures you of satisfactory performance and quality. Send for Bulletin No. 169.



THE GREEN *Fuel Economizer* COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

MARMADUKE

Continued from page 198

plant. I've run into a lot of mighty nice people in all the jobs I've had,' he wound up, 'but that gang was the finest. I sure hated to leave there.'

"'Well, then,' I answered, when he got through, 'in that case, you'll find exactly the same kind of people in this plant.'"

Marmaduke grabbed another cocktail, gulped it down—then added, "You McGraw-Hill boys and girls see only Phil Swain's good side because that's all he sees in you. That's all there is to getting along with your shipmates—anywhere.

"Trouble with that theory," he added thoughtfully, "is it's so damned simple even some intelligent people just can't seem to understand it."

More ARGUMENT CORNER

Begins on page 125

"Copper mercuric io-who?" would come back the clerk. Finally, we found A D Mackay, 198 Broadway, New York 4, N. Y., industrial chemists. "Sure, we have the stuff," we joyfully heard. "It's worth about $2.00 an ounce, but an ounce goes a long way. It comes in powder form and can be mixed with any binder, such as shellac, and brushed over parts that are to indicate temperature changes. Then a glance tells approximate temperature by its color."

We also found that Tempil Corp, 132 W 22nd St, N. Y. 11, N. Y. bottles their Thermindex *temperature - indicating paints. They furnish color charts showing color corresponding to temperature.*

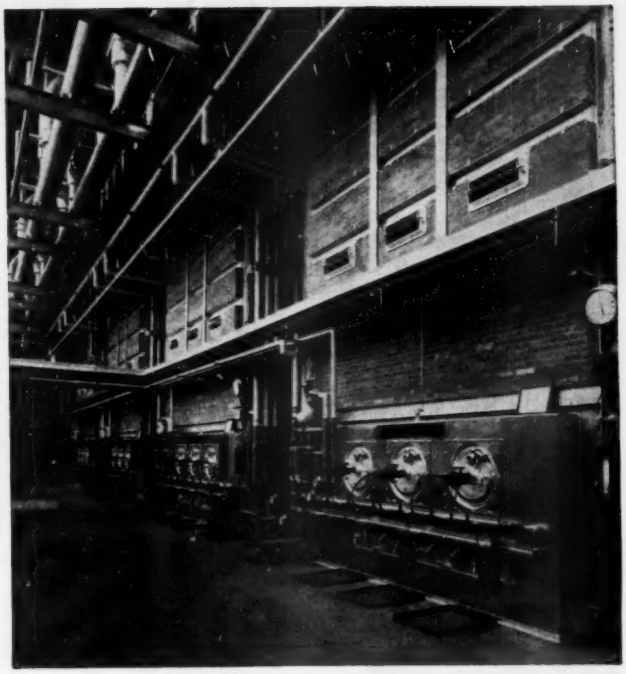
We Called It 'Cold Forging'

I'VE USED W H Ostander's "Practical Aid" (p 136, June POWER) of whanging a ball check to form a new seat on many field service trips. Being at a loss for proper technical terminology, one local representative dubbed the process "cold forging" and it's now suggested in our instruction manuals.

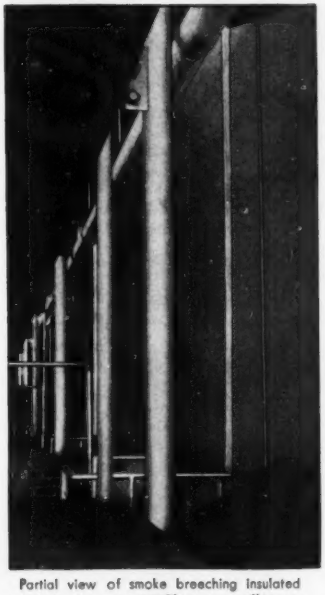
On the same page of that issue, S Nowakowski describes a hookup for proportioning chemicals to feedwater by driving the chemical pump with water from the water side of the feed pump. We've used a similar installation since 1941 with steam-driven proportioning pumps hooked up to the steam side of feed pumps.

E R FRANKLIN *Providence, R. I.*
Proportioneers, Inc

Boiler room of Buffalo State Hospital, Buffalo, N. Y. All boilers, heated equipment, and steam lines are insulated with "Featherweight" 85% Magnesia. Cold water pipes insulated with K&M Duplex.



More than four and one-half miles of steam lines



Partial view of smoke breeching insulated with "Featherweight" 85% Magnesia 3" blocks and finished with Asbestos cement.

OWNER: State of New York
ARCHITECT: Cornelius J. White, State Architect
GENERAL CONTRACTOR: The John W. Cowper Co., Buffalo, N. Y.
HEATING CONTRACTOR: Quackenbush Company, Buffalo, N. Y.
INSULATION CONTRACTOR: E. J. Eddy, Inc., Buffalo, N. Y.

—insulated with "FEATHERWEIGHT"® 85% MAGNESIA

From the new boiler house of the Buffalo State Hospital, 24,000 lineal feet of piping carry steam throughout the institution. And, to guard against heat losses, the entire system—pipes, boilers, smoke breeching, and other heated surfaces—is insulated with "Featherweight" 85% Magnesia.

"Featherweight" 85% Magnesia provides efficient, durable insulation at a cost that insures savings. And the savings are continuous: "Featherweight" will last the life of your heating system!

Keasbey & Mattison "Featherweight" 85% Magnesia Insulation is made in blocks, laggings, and standard-size pipe coverings for all applications up to 600° F. Other K&M Insulations cover service ranges from 40° F. to 1900° F. Our local distributor, who is an experienced applicator, will be glad to give you complete information. Or, write us.

Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M Next to asbestos ®

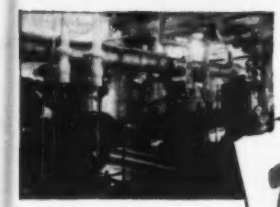
In Canada: **ATLAS ASBESTOS COMPANY, LTD., MONTREAL, TORONTO, WINNIPEG, VANCOUVER**

What Other Drive Gives You...

1. BY-PRODUCT POWER

Power to drive pumps, blowers or stokers...auxiliary electrical supply for special needs...off-peak or standby generating capacity—these can be obtained almost free by utilizing the By-Product Power available through Troy Steam Engines.

Steam used for heating or processing packs plenty of horse power as well as B.T.U.s. Under the right conditions, Troy Steam Engines can extract this latent power while actually improving the heat balance. By-Product Power can be converted into A.C. or D.C. electricity by efficient Troy Generating Sets, or it can be utilized directly to drive stokers, fans, pumps, blowers, kilns, compressors, mixers and similar equipment. With the Type EN Governor, constant speed can be maintained accurately; or speed can be automatically varied over an exceptionally wide range.



Double duty: Steam drives high pressure pumps and provides heat for processing in this installation of multiple Troy Steam Engines in the Port Arthur refinery of The Texas Company.

Plus-

2 HIGH STARTING TORQUE

3 UTMOST FLEXIBILITY

4 SIMPLICITY, LONG LIFE

5 ACCURATE, FAST SPEED CONTROL

Which Do *You* Need?

If your drive needs any or all of these five characteristics, the *modern* Troy Steam Engine is indicated. Send us your drive requirements and steam conditions, and our engineers will be glad to recommend the right type and size Troy engine to meet your needs.

Send for Bulletin 306

TROY

Troy Engine & Machine Co.

Power Equipment Division

2509 RAILROAD AVENUE • TROY, PENNSYLVANIA

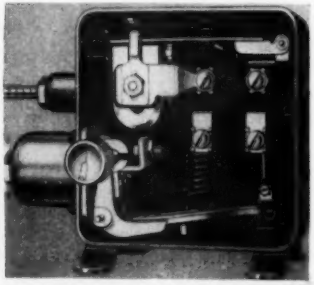
ALARM SWITCHES

Continued from page 85

"fixed" contact. Actually, its contact, *K*, is fixed only until contacts close; after that it travels along with indicating pointer, as it is mounted on the end of a pivoted arm held in place by a light spring. This permits indicating pointer to show correct temperature at all times and also avoids unnecessary strain on mechanism. Because of lack of snap action, current-carrying capacity is limited to about 50 watts or 0.5 amp. This usually means use of a relay.

Watertight switch designed for Navy. Fig. 10, withstands heavy blows and severe vibration. It is specified to take severe shocks of 2000 ftlb and to operate reliably when submerged in 25 ft of water. Metallic bellows works by pressure of volatile liquid, and permanent magnet gives snap action. Differential is nonadjustable. Range-setting adjustment is by a screw inside the case.

Combination temperature and pressure switches are often used on small engines and where it is necessary to cut costs, but such devices usually cannot indicate which of the two conditions is at fault. Fig. 11 shows interior of a 4-wire switch that controls two separate circuits. When either water temperature rises or oil pressure falls, one circuit opens and other closes.



11 Interior of 4-wire combination temperature and pressure switch device

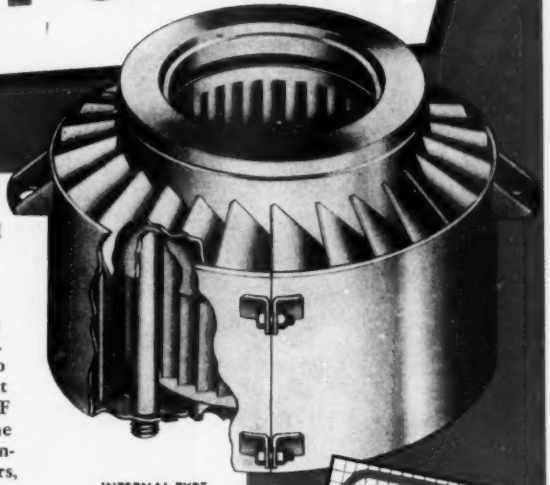
Liquid-level switches may be either directly actuated by floats or by air pressure corresponding to head of liquid. Constructions used are the same as in common liquid-level switches for controlling pump motors.

More PLANT PROBLEMS

Begins on page 132

SELECTION HINTS. Metering condensate returns is practical, but install meter correctly if you want accurate readings. When you order meter tell manufacturer what liquid you'll handle and its pressure and temperature. Install it on discharge side of pump, if possible. In

ANNOUNCING the NEW Anderson Hi-eF Purifiers



INTERNAL TYPE PURIFIER
Bulletin #100

DELIVERS VIRTUALLY 100% QUALITY VAPOR!

Now, the V. D. Anderson Company, makers of Super-Silvertop Steam Traps, offers you a complete line of new Anderson Hi-eF Purifiers —the finest separating devices ever developed. These high efficiency units are guaranteed to remove virtually 100% of the entrainment from vapors—*even at extreme velocities!* Hi-eF Purifiers quickly amortize themselves. The internal-type Purifier illustrated here, for instance, produces clean steam from boilers, thereby increasing the life span of reciprocating engines, turbines, and super heater tubes. In evaporator operation, they boost production and in food and petroleum processing, assure a better, purer product.

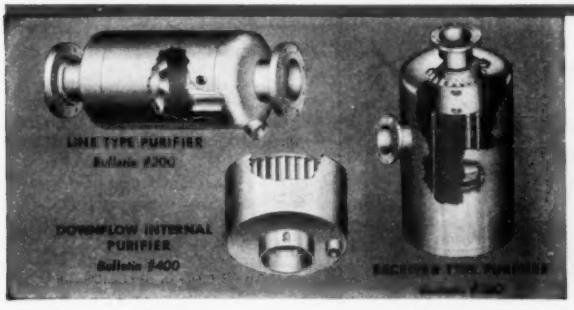
Install Anderson Hi-eF Purifiers and forget them . . . they are self cleaning . . . without baffles or any moving parts. Good fluid dynamic design permits extremely low pressure drop.

Anderson Hi-eF Purifiers give you purifier efficiency at the price of an ordinary separator! Save by investigating these new, money saving units today. Anderson makes complete range of types in all sizes to any specifications.

Mail coupon for further information today.

ANDERSON Hi-eF PURIFIERS

MADE BY THE MAKERS OF SUPER-SILVERTOP STEAM TRAPS AND STRAINERS



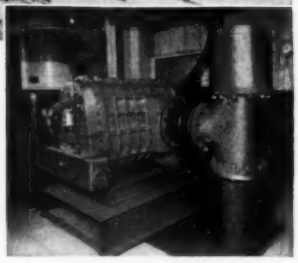
PURIFIER DIVISION,
THE V. D. ANDERSON COMPANY
1934 West 96th Street • Cleveland 2, Ohio

Gentlemen: Please send additional information on Anderson Hi-eF Purifiers described in:

☐ Bulletin #100 ☐ Bulletin #300
☐ Bulletin #200 ☐ Bulletin #400

Name .....
Company .....
Address .....
City ..... Zone ..... State .....

Expansion at BRILLO includes: STANDARDAIRE BLOWERS



Installation of Standardaire Blower at Brillo Manufacturing Co.

TO keep pace with the ever increasing demand for Brillo Manufacturing Company products, numerous plant additions have been made since 1913, when the company first started operations. Another million dollar expansion program is now underway—when completed it will provide increased floor space for greater productive capacity. In conjunction with this program Brillo has installed two 105B2S Standardaire Blowers, each having a capacity of 3600 c. f. m. at 1750 r. p. m. These blowers are in continuous round-the-clock service, supplying the necessary air to whisk away the metal turnings incidental to the processing of the famous Brillo pads. Standardaire Blowers are built to take this grueling service in stride. Rigid material specifications and skillful workmanship assure long, trouble-free performance, even when operating under extraordinary conditions. Standardaire Blowers are winning new users every day due to their ability to produce more air in less space with less power consumption.

For complete information write Dept. E6
READ STANDARD CORPORATION,
370 Lexington Avenue, New York 17, N. Y.

BLOWER-STOKER DIVISION

FORMERLY The Standard Stoker Co., Inc.
ONLY THE NAME IS CHANGED

READ STANDARD
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NEW YORK • CHICAGO • ERIE • YORK • LOS ANGELES

More PLANT PROBLEMS

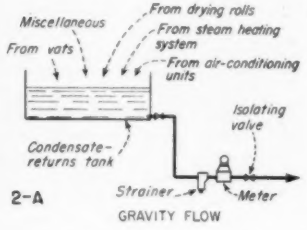
Begins on page 132

gravity feed systems mount the meter at lowest point in piping to get maximum head possible. This prevents air or vapor passing through meter and giving a false reading. In systems with a pump have suction line tight so no air enters meter. Don't run pump when supply tank or suction pipe is empty. Try to keep meter full between periods of use.

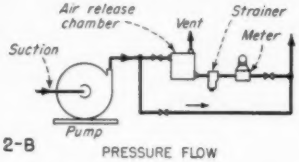
Fit bypass around meter if line must be kept in continuous operation. Flush pipe completely before installing meter. This removes all pipe cuttings, chips and dirt. Install strainer ahead of meter to prevent entrance of dirt after system is in operation.

Test each meter after installation. There may be a slight error from working conditions. Some meters have a calibrating screw for small corrections. Certain manufacturers supply a test sheet with the meter and replace gears if readings are inaccurate.

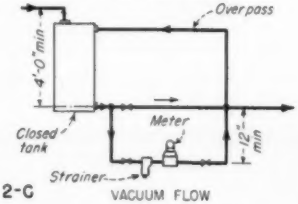
J C TORREANO *Calumet, Mich.*



2-A GRAVITY FLOW



2-B PRESSURE FLOW



2-C VACUUM FLOW

A SIMPLE JOB. To meter total returns so you can check them against total supply, set up a settling tank as in 2-*A*. Flow from tank to makeup line is metered without any danger of flashing. Hookup shown is typical for gravity returns.

Use air-release chamber ahead of meter as in 2-*B* to measure condensate flow through a line under pressure. Vent

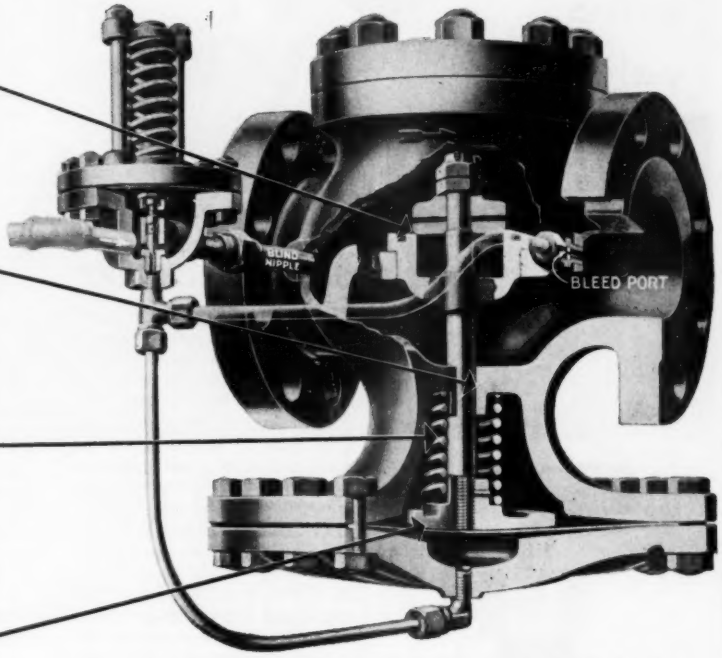
WHY Spence Regulators Outlast The Field

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than twenty years of experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.



Spence Type EQ back pressure regulator — operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

DURABILITY — Spence Regulators perform dependably year after year.

ACCURACY — You can be sure of accurate control for the life of the regulator.

MAINTENANCE — You don't need expensive repairs or special maintenance. That means less down-time, less time and money wasted on replacement of parts.

SE-110

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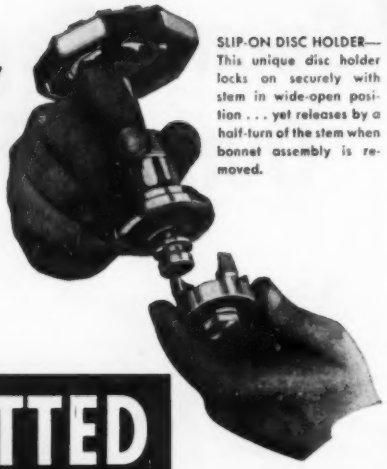
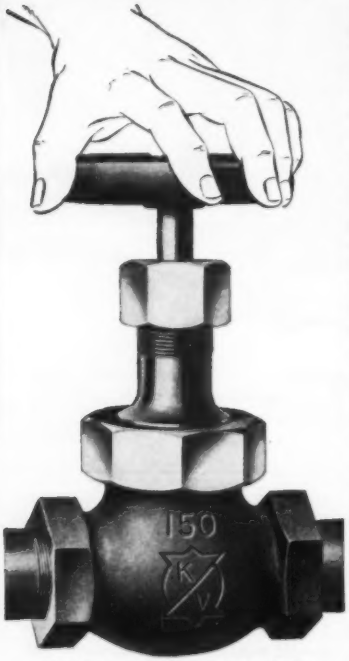
for longer service, easier maintenance



SLIP-ON DISC HOLDER—This unique disc holder locks on securely with stem in wide-open position . . . yet releases by a half-turn of the stem when bonnet assembly is removed.



KENNEDY Fig. 89, Bronze Globe Valve
150 lbs. steam, 300 lbs. WOG, non-shock

YOU KEEP MAINTENANCE COSTS DOWN with KENNEDY Bronze Valves because they are *job-fitted*—every valve specially designed and engineered for the job it has to do.

THE KENNEDY FIG. 89, for example, is designed for services where frequent inspection, cleaning of internal parts and quick renewal of the composition disc are required.

HEAVY UNION BONNET RING permits easy dismantling and reassembly of the valve without risk of damage to body-bonnet bearing surfaces.

RENEWABLE COMPOSITION DISCS are available in a variety of materials to meet a wide range of fluid, pressure and temperature requirements.

RUGGED BODY has an unusually high seat to prolong disc life by utilizing full thickness of disc before disc-holder strikes the base of the raised seat.

LONG-WEARING PACKING—molded rings of lubricated asbestos—maintains easy operation and tight seal to prevent leaks. Valve can be repacked under pressure.

FOR BEST RESULTS and real economy, standardize on KENNEDY Bronze Valves . . . and the complete line of KENNEDY Iron Valves, Malleable, Cast-Iron and Bronze Pipe Fittings.

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VALVE MFG. CO. • ELMIRA, N.Y.

VALVES • PIPE FITTINGS • FIRE HYDRANTS

More PLANT PROBLEMS

Begins on page 132

chamber regularly by hand to prevent an air lock.

To measure condensate flow in a vacuum line you need a closed tank with an overpass as in 2-*C*. Spot meter lower than bypass so no air or vapor enters meter. Keep a slight head at meter outlet.

No matter what type line meter is connected to, be sure you have shutoff valves that can isolate meter and strainer for maintenance. Strainer is needed to protect meter from sediment, pipe scale and other materials that might enter pipe. Be sure meter is used only for liquid it was designed to handle. Also see that liquid pressure and temperature do not exceed manufacturer's recommendations.

A J BREUGELMANS *Hoboken, N J*

More POWER NEWS

Begins on page 148

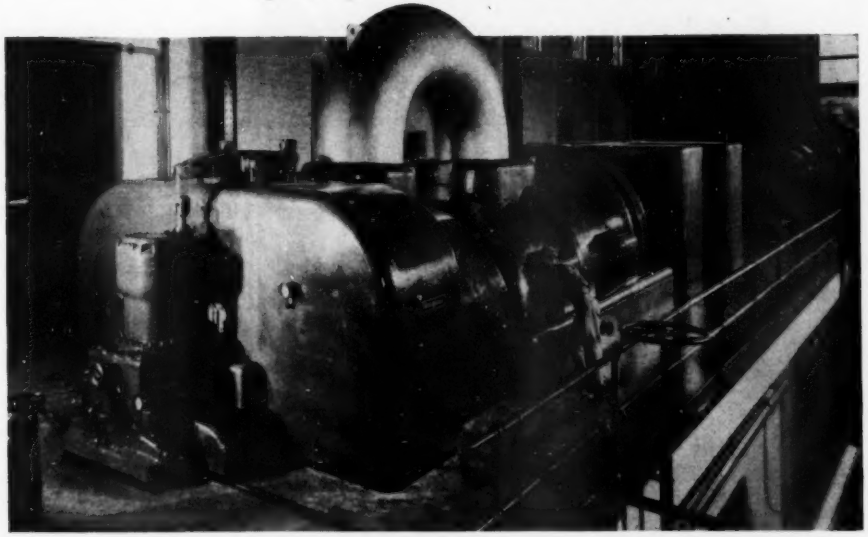
neering shortage problem is to be solved. The ability of American Industry to produce the huge amount of weapons and materials needed will depend in large measure on the nation's success in maintaining a steady flow of engineering talent into industry. The demand for engineers must be met to supply both industrial and governmental requirements. The success of the manpower aspects of the national defense mobilization is dependent to a very large degree on the successful solution of this acute problem."

Ceramic Coatings Prevent Corrosion

An investigation of the corrosive effects of lead bromide vapors on various heat-resistant alloys, both with and without protective ceramic coatings, has recently been completed at the National Bureau of Standards. Lead bromide, the principal lead compound present in aircraft exhaust gases, has been suspected of contributing significantly to exhaust-system corrosion. Until now, however, available data bearing on this question have been few and inconclusive. The NBS investigation demonstrates that the uncoated alloys corrode fairly rapidly when exposed to lead bromide vapors at high temperatures, but that certain ceramic coatings effectively prevent corrosion under the same conditions. Sponsored by the National Advisory Committee for Aeronautics, the studies were conducted by Dwight G Moore and Mary A Mason of the NBS enameled metals laboratory.

Lead bromide is present in the exhaust gases of all engines that use leaded gasoline as a fuel. Aviation gasoline is more heavily leaded than automobile fuel, however, and aircraft exhaust temperatures are higher. For these reasons, corrosion from lead bromide is a greater possibility in aircraft

2 *ways to insure a clean lubricating system for your new turbine . . .*



FLUSH with Gulf Turbine Flushing Oil

FILL with Gulfcrest, the world's finest turbine oil

By taking these two steps, you can insure top lubricating efficiency down through the years for your new steam turbine.

The use of Gulf Turbine Flushing Oil—before the initial fill of lubricating oil—will remove grease-type slushing compounds and carry away harmful abrasives which might be in the circulating system. And, it protects all oil-bathed surfaces against rust. Because Gulf Turbine Flushing Oil is itself a satisfactory lubricant, the undrained portion does not impair the lubricating value of the turbine oil.

Then, to keep the new system clean, fill with Gulfcrest Oil. Because of its outstanding resistance to oxidation, Gulfcrest maintains an exceptionally low neutralization number, and lasts indefinitely. With this quality oil and good operating practice, you can be sure there will be no sludge deposits in cooler tubes, bearing pedestals, or oil lines to worry about.

To get these benefits for your new turbines, call in a Gulf Lubrication Engineer today. Write, wire, or phone your nearest Gulf office.

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NO. 33

Production and maintenance men can count on Masoneilan Pressure Reducing Valves to give accurate control of steam, water or air. Quality constructed of high grade materials they give long-lived service . . . require minimum of maintenance because they are *built up to the job* not down to price.

No. 33 for steam or air service—sizes from ⅛" to ¾". Reduced pressure ranges 2-20; 20-40; 40-100 psi. Maximum working pressure 200 lbs.

No. 227 for water service — sizes ¼" to 2". Reduced pressure ranges 10 to 60 psi. Maximum working pressure 150 psi. Also available for air service from ¼" to 1".

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More POWER NEWS

Begins on page 148

than in automobiles. The fact that lead bromide vapors prove corrosive under certain conditions does not, of course, mean that leaded gasoline is undesirable as a motor fuel.

The lead bromide found in exhaust gases results from the interaction of tetraethyl lead and ethylene dibromide, the active additives of leaded gasoline. The tetraethyl lead is added to improve combustion characteristics, while the ethylene dibromide acts as a scavenging agent. In this capacity the ethylene dibromide converts the lead oxide, which would otherwise be formed during combustion, into lead bromide. Lead bromide has a considerably higher vapor pressure than lead oxide and is, therefore, more readily passed through the exhaust system as a vapor.

Five heat-resisting alloys were investigated by NBS: Inconel (a high nickel alloy), types 347 and 19-9DL stainless steels, Vitallium, and S-816. The first three alloys are in regular use in exhaust systems. Vitallium and S-816 are turbine-blade alloys and, although too expensive for general exhaust system use, could be used for small critical parts. Specimens of each alloy with five different coating conditions were studied: an uncoated specimen, a preoxidized specimen, and three ceramic-coated specimens. The ceramic coatings, all commercially available, were NBS types A-417, A-19, and A-520. Specimens were exposed to lead bromide vapor for periods up to six hours in an air atmosphere at temperatures of 1350, 1500 and 1650 F.

COMING EVENTS

Oct 11-12—American Society of Mechanical Engineers, fuels div, Hotel Roanoke, Roanoke, Va. O B Schier, chairman, ASME, 29 W. 39th St, New York 18.

Oct 22-24—Engineers' Society of Western Pennsylvania, Twelfth Annual Water Conference, Hotel William Penn, Pittsburgh, Pa. W M Porter, secy, ESWP, Hotel William Penn

Oct 22-25—Diesel Engine Operators Conference, Oklahoma A & M College, Stillwater, Okla. Prof M L Powers, Engrg Extension Div, Oklahoma A & M

Nov 1-2—Pennsylvania Electric Assn, Fort Stanwix Hotel, Johnstown, Pa. E Gordon, chairman, Potomac Edison Co, Hagerstown, Md.

Nov 5-8—All-Industry Refrigeration and Air-Conditioning Exposition, Navy Pier, Chicago, Ill. George E Mills, show director, 1346 Connecticut Ave, NW, Washington 6, D. C.

Nov 26-Dec 1—23rd Exposition of Chemical Industries, Grand Central Palace, New York, N. Y. C F Foth, mgr, International Exposition Co, Grand Central Palace, New York 17, N. Y.

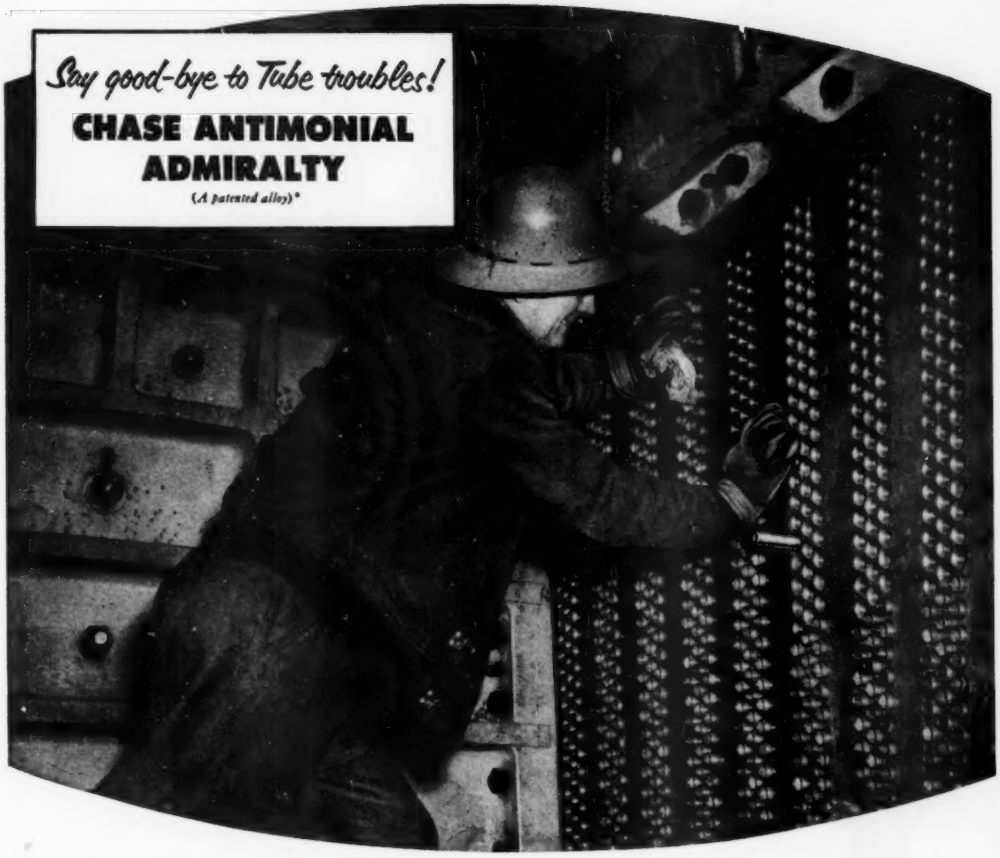
U. S. Energy Use To Keep Booming

Consumption of energy in the U. S. by the year 2000 will be equal to the current consumption of the entire world, or

Say good-bye to Tube troubles!

CHASE ANTIMONIAL ADMIRALTY

*(A patented alloy)**



LONG-LASTING because there's enough antimony to resist dezincification.

LONG-LASTING because antimony doesn't affect the grain structure of the metal—won't weaken the tube.

LONG-LASTING because years of tests and actual use of Chase Antimonial Admiralty have proved that the right amount of antimony increases the life of the tube.

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More POWER NEWS

Begins on page 148

about 25 trillion horsepower-hours per year, G. W. Gleeson, dean of the School of Engineering and Industrial Arts at Oregon State College, declared in an address at the semiannual meeting of The American Society of Heating and Ventilating Engineers in Portland, Oregon. He urged real consideration be given to the development of the continuous sources of energy, water power, energy from vegetation (direct and indirect, solar energy, wind power, earth heat, tidal power, tropical waters and the heat pump.

With the exception of hydroelectric power, our energy now comes from discontinuous sources, whose fuels are finite in amount. Although there are ample and available sources of energy to provide for our immediate requirements, he pointed out, the cream has already been consumed. Within the coming century, the fuel situation as we now know it will not exist, he declared. He listed among the discontinuous sources of energy, coal, petroleum, oil shales, natural gas and atomic energy.

Dean Gleeson said atomic energy is unique in that it is the only energy source in the discontinuous category that does not depend upon a fossil fuel, and accordingly uses the only fuel that is inorganic. Energy produced by nuclear fission has developed the concept of a practically inexhaustible energy, which is certainly not true. As with any energy source it is dependent on a fuel supply in the form of fissionable material, which like other fuels is definitely limited in amount, he emphasized.

TVA to Double Power Output

Officials of the Tennessee Valley Authority testified before the Federal Power Commission, in support of a proposed sale to TVA by Texas Gas Transmission Corp of 90 million cubic feet of natural gas a day for use at a new steam-generating plant at Johnsonville, Tenn.—largest generating plant in the TVA system.

They testified that the gas is urgently required to enable the agency to meet the rapidly expanding requirements of defense production, such as atomic energy plants at Oak Ridge, Tenn. and Paducah, Ky., a supersonic research center in the area, and other military projects requiring additional power from TVA.

Concerning critical materials, it would require less steel to construct gas facilities for TVA than would be required to move an equal amount of coal, according to T Marshall Johnson, assistant chief, power-production branch, TVA. Some 7400 tons of steel will be necessary for TVA's gas operations, he testified. To move that much coal, he said, would require 7150 tons of steel for hopper cars and barges alone.

Dr Jess Harrison Davis was named to succeed Dr Harvey Nathaniel Davis (no relation) as president of **Stevens Institute of Technology,** Hoboken, N. J. He assumed his duties Sept 1.

3,500,000

ROSES MUST NOT GET COLD

E. G. HILL CO., INC., RICHMOND, INDIANA

Three and one-half million roses, forty thousand orchids and nearly a million gardenias are grown each year in this huge greenhouse.

Investment in plants and labor is tremendous—losses from even brief chilling would be disastrous.

Detroit RotoStokers Guard Against Loss

Detroit RotoStokers are good protection. These dependable spreader stokers keep up steam without fail.

Available with power, hand-dumping or stationary grates—will burn any type Bituminous coal or Lignite—high efficiency. They have a record for long life, with low maintenance.

Write for bulletin on Detroit RotoStokers. No obligation.

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CLEAN SMALL TUBES FAST

With ROTOJET® Junior Tube Cleaners you can clean tubes as small as .495" I.D. quickly and economically. Very little headroom is required for either vertical or horizontal tubes. Tube bundles can be cleaned without removal from shell.

The unusual power developed by the ROTOJET Motor is due to its simple design and exclusive Rotocentric (egg-shape) bore cylinder. A shaft and a blade are the only moving parts. Positive contact between blade and cylinder is always maintained. No leakage. No stalling at low speeds. Water-driven motors are also available.

Try ROTOJET Junior, and you will never go back to heavy, slow, external type cleaners costing many times more.

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S32 ROTOJET Junior Air-driven Motor, universal joint, cone cutter.

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C439 ROTOJET Junior Air-driven Motor, universal joint, drill head.

C434 ROTOJET Junior Air-driven Motor, flexible coupling, expanding brush.

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ELLIOTT COMPANY-ROTO DIVISION
153 Sussex Avenue Newark 1, N. J.

FUEL-OIL SYSTEM

Continued from page 86

valves at the tanks and stopping the pumps allowed the oil to run back into the suction lines under pressure. We found small leaks at strainer flanges, screwed union joints, welded ell and valve stuffing boxes. These leaks were all stopped.

The west pump still lagged in pressure, so we dismantled it. It had about 6 mils total clearance at the gear end where it should have only 3. The outboard end plate was worn about 2 mils. We faced it down in a lathe to reduce clearance to 4 mils. This reduced leakage past gear ends so the pump now produced over 300 psig. We raised relief valve settings on both pumps to about 260 psig.

Finally, we procured burner tips, using about 300 gph. With these the firing rate can be adjusted by cutting burners in and out. Because pump capacity is not exceeded, pressure stays up, giving better atomization and combustion. Thus the erring fuel-oil system was reformed and now works without fuss or trouble.

The Current Need For Engineers

A June 1951 survey of the needs of 378 companies and government agencies shows about 80,000 engineers are needed now, exclusive of the needs of the military. When the 1951 graduating class of 38,000 is absorbed there will still be an unfilled demand for 42,000 engineering graduates. But a recent study of the 1951 graduates showed that the military, through ROTC and reserve programs, and through the Selective Service System, will siphon off about 19,000 graduates. So the actual unfilled demand will then be for more than 60,000 engineers.

Thus, the urgent need for engineers cannot be met through the current sources of supply. The 1952 graduating class will be only about 26,000; 1953 about 17,000; 1954 about 12,000.

Impact of the present partial mobilization has caused another sharp increase in the demand for engineers to speed up and improve the design, development, and production of the implements of modern warfare and civilian manufacture.

The Engineering Manpower Commission of Engineers Joint Council has expressed concern over the magnitude and probable consequences of the shortage of engineers and scientists to the national health, safety and interest. Studies will be made to determine to what extent the shortage is a short-term or a long-term problem, and what efforts can be made to aid government, private enterprise, and others in determining policies to promote the most effective utilization of engineers and to aid in maintaining the supply so our technological superiority will not suffer.

NOBODY GUESSES WHEN YOU USE . . .

WALSEAL*

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When you see this fillet of alloy, and the fitting is Walseal you know that you have penetration because the alloy comes from the inside.

Cutaway view of a Walseal Tee showing: 1—factory-inserted ring of silver brazing alloy; 2—fillet of silver brazing alloy that appears upon completion of Silbraz joint; 3—cutaway view of the completed Silbraz joint showing that silver brazing alloy has flowed in both directions from the factory inserted ring.

When you make Silbraz* joints in your brass, copper, or copper-nickel pipe lines with Walseal Valves, Fittings, or Flanges you know you have the right amount of the correct type of silver brazing alloy. The ring of Sil-Fos brazing alloy is factory-inserted in the ports of Walseal products at the time of manufacture.

No lost time or motion in handling the alloy . . . no difficulty in getting full penetration of the alloy regardless of the position of the valve or fitting . . . no guessing whether the joint is made right . . . the fillet of alloy that shows up when the Silbraz joint is completed, comes from the inside!! And, whether you've made the Silbraz joint yourself, or inspecting the work of another, you know that if the silver alloy fillet is visible, and the valve or fitting is Walseal, you have full penetration. That's why nobody guesses when you use Walseal!

Walseal products are backed by the reputation of the Walworth Company, manufacturers of valves and pipe fittings since 1842.

For full information regarding Silbraz joints made with Walseal products, write for Circular 84.

*Patented—Reg. U. S. Pat. Off.

Recommended for

- Hot and Cold Water Circulating Systems
- Boiler Feed Lines
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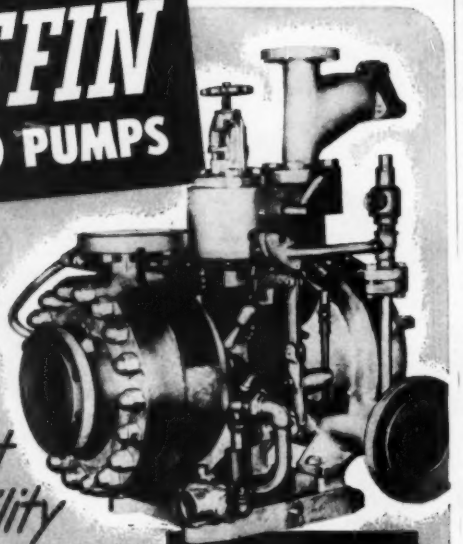
combine **performance** AND **service** *for utmost dependability*



COFFIN TURBO PUMP MODEL TC adaptable for tank cleaning, fire lines, boiler feed, general service.

These are the pumps marine and industrial engineers count on for high efficiency operation with minimum steam consumption. Matched pump, turbine and governors are engineered in one compact, lightweight assembly with all parts made to gauge and replaceable without fitting. Rigid one piece steel casing and heavy shaft with ample clearance prevent damage from dry operation. High pumping efficiency combined with high speed, two-bucket row turbines conserve steam. Check, now, on all the features that make Coffin the leading choice for tough pumping jobs in every industry!

Single Stage Provides 3 to 12 Stage Pump Performance

- STEAM PRESSURES TO 850 PSI
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the new Coffin File Folder on Turbo Pumps is completely illustrated and contains all the facts, operating data and specifications needed for general industrial, marine, and railroad pumping applications. Call or write for your copy, today!

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REPRESENTATIVES IN ALL PRINCIPAL CITIES

WITH OUR READERS

Continued from page 5

To Reader Bacica, last month, went an orchid for spotting an error; to the editors, a lemon. Now, for Reader Gorter, an orchid also, and the usual to the editors. We've got a few orchids left, but we're getting awfully sick of lemons.—*Ed.*

GETTING IN THE SCRAP . . .

Jotted on a copy of Phil Swain's September editorial (p 67), a reader, whose signature we couldn't quite make out, puts forward some suggestions for increasing scrap collections. His basic idea is to use incentives: for example, for every ton of scrap turned in, present the producer with an allocation certificate for some stated amount of finished materials. It would be a good idea, he thinks, to put restrictions on negotiating such certificates to avoid use in black-market operations. He sees this scheme as a way of supplementing short allocations of materials needed for legitimate use.

Another idea, to foster individual effort in seeking out scrap: Pay 25% of proceeds from scrap to individual who first calls attention to it.—*Ed.*

Du Pont Develops New Soot Collector

For the process-industry manufacturer, soot frequently is pay dirt. Plant operators have experimented with collection bags installed in the stack discharge for years to salvage stack waste. Until the development of du Pont's tough *Orlon* with dimensional stability to heated gases and resistance to acids and acidic fumes, collection bags often failed with resultant loss of valued product and contamination of the atmosphere.

Advantages of *Orlon*, according to user reports, are good-to-excellent resistance to mineral acids, fair resistance to weak alkalies, and freedom from harm by common solvents, oils, greases, neutral and most acid salts. Added to these properties are its dimensional stability to heated gases and its resistance to acids and acidic fumes at high temperatures.

Gas Explosion Prevention Described

Precautions by which the danger of explosions of gas or vapor can be minimized in industrial plants are explained in Bureau of Mines' *Circular 7601, Gas Explosions and Their Prevention.*

The circular explains the limits of flammability of various gases and vapors—that is, the range of composition within which a mixture of gas and air is explosive. For instance, a mixture of methane and air will explode if its methane content is not less than 5 nor more than 14% by volume. The publication notes that changes in temperature and presure affect the limits of flammability, and that under certain conditions some gases and vapors, such as acetylene or hydrazine, can explode in the absence of air or oxygen. Obtainable from Bureau of Mines, Publications Distribution Section, 4800 Forbes St, Pittsburgh 13.

More Scrap! More Steel!!

AMERICA expects the steel industry to produce more steel this year. More steel requires additional scrap. Steelmakers need the help of all steel users to get every possible extra pound of scrap to meet the nation's call for more steel production. We urge you to do your part. Turn in your scrap through your regular channels.

YOUR SCRAP IS NEEDED — YOUNGSTOWN

The Youngstown Sheet and Tube Company

General Offices—Youngstown 1, Ohio
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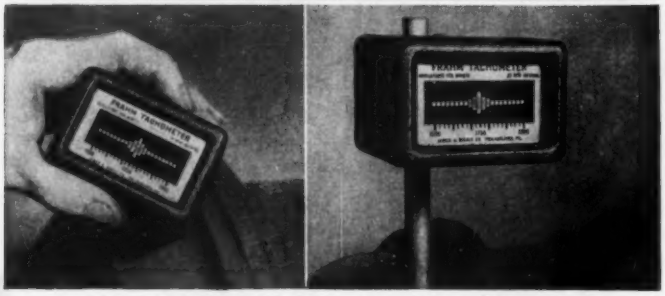
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment

BIDDLE

NUMBER 4 OF A SERIES

Instrument News



MEASURE SPEED BY RESONANCE
FRAHM® RESONANT REED TACHOMETERS

The Miniature Frahm instruments shown above weigh about 12 ounces and measure approximately 3" x 2" x 2¾". Various speed ranges are available from 1000-1500 to 9000-13,000.

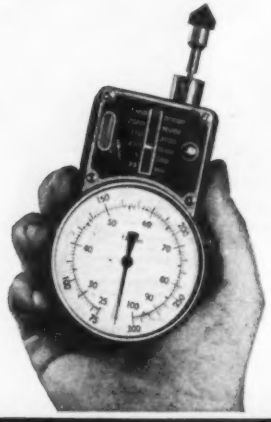
The phenomenon of resonance activates the delicately tuned reeds when touched to any part of a rotating machine or when permanently mounted. 60° or 90° brackets are furnished where mounting is desired. In confined spaces, the convenience of merely touching the instrument to any part of the machine casing is highly desirable and a considerable safety factor.

Since there are no movable parts in Frahm Resonant Reed Tachometers there is nothing to require maintenance. They are built to take rugged handling.

Frahm Tachometers are made in a variety of shapes and sizes with splash-proof cases and reeds tuned to guaranteed accuracy within 0.5%.

Write for Bulletin 31-P.

WIDE RANGE PRECISION HAND TACHOMETER
THE DR. HORN TACHOMETER



We are now prepared to make immediate delivery of this instrument, considered by many to be the ultimate in a fine speed measuring device. Pointer affords instantaneous reading of rpm of rotating shafts, or linear and peripheral speeds, regardless of direction of rotation. Measures in six ranges from 25 rpm to 30,000 rpm. Protected against overspeeding damage. Operates equally well in a vertical, horizontal, or slanting position. Simple mechanism. Low maintenance. Long life.

James G. Biddle Co. is the sole distributor and authorized service agency for these highly regarded instruments.

Write for Bulletin 35-65-P.

JAMES G. BIDDLE CO., 1316 ARCH ST.
PHILADELPHIA 7, PA.

ELECTRICAL TESTING • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT

My Biggest Boner

► SOME YEARS BACK I was advanced from mechanic to refrigeration engineer and it went to my head. One holiday, with only a skeleton crew on duty, the hotel front office reported an elevator hatch-door handle loose. Being short-handed, the chief ordered me to have a look-see.

A bit indignant about such a mediocre assignment, I grabbed a few tools and headed for the lobby. There a very pretty elevator girl showed me the trouble. She seemed happy to have me come and fix it and her flattery swelled my big head all the more.

A simple job, I thought . . . tighten 4 FH brass screws and peen some of the brass plate into the screw slots with a center punch. It required a lot of hammering, and the cute little operator kept cautioning me about the noise.

Disgusted, I closed the hatch door and car gate and ordered her to take me to the 10th floor where the noise would not bother anybody. She began to argue, but I insisted and she meekly obeyed.

At the 10th floor, I opened the car gate, and with hammer and punch in hand, I began to finish the job. To my amazement and embarrassment I realized that *the hatch door I was to fix was still down at the lobby level.*

The cute little operator merely smiled and closed the car gate. There wasn't a word said during that long trip down to the lobby.

JOSEPH P SCHULTE
New York City
Refrigeration Engineer, Hotel Astor

• What is your "biggest boner"? We'll pay ten dollars for each one we publish

S-E-Co. Coal Scales and S-E-Co. Coal Valves → Complete Unit

S-E-Co. Coal Scales are usually furnished complete with **S-E-Co.** Coal Valves, scale inlet slip joint and, if stoker fired plant, a CONICAL Non-Segregating Coal Distributor in order to give a properly engineered installation from bunker outlet to pulverizer feeder or stoker hopper.

S-E-Co. design of layout and equipment assures better flow of coal, even when it is fine and wet. Coal flow alarms, properly located, assure operator of continuous coal flow. Dust-tight construction is a standard feature.

Complete **S-E-Co.** "Bunker to Stoker" or "Bunker to Pulverizer" installations provide a better all around operating installation with lower engineering costs.

SEND YOUR INQUIRY TO **STOCK EQUIPMENT COMPANY**

715 P HANNA BUILDING • CLEVELAND 15, OHIO

. . . NEW Heat Saving Efficiency

MUNDET 85% MAGNESIA INSULATION provides maximum strength and resistance to vibration. Extra durability is built into this insulation. In pipe covering and blocks, it is precision manufactured on the latest type of automatic equipment to insure uniform standards. It does not "powder", settle or disintegrate. It is unaffected by steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation when you specify Mundet 85% Magnesia Pipe Covering and Blocks. *Write for new heat insulation Engineering & Specification Data Manual.*

Mundet Cork Corporation

Insulation Division, 7107 Tonnelle Ave., North Bergen, N. J.

Mundet district offices are located in these cities:

ATLANTA 339-41 Elizabeth St., N.E.
BALTIMORE 30 612 Battery Ave.
BOSTON 57 Regent St., N. Cambridge 40
CHARLOTTE 3, N. C. 507 S. Cedar St.
CINCINNATI 2 427 West 4th St.
DALLAS 10 601 Second Ave.
DETROIT 21 14401 Prairie Ave.
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ST. LOUIS 9 3176 Brannon Ave.
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INSULATION FOR HIGH & LOW TEMPERATURE

My Biggest Boner

► I SLIPPED on the very first rung of the ladder of power-plant success. My supervisor wanted a small jackshaft stopped and removed from the ceiling as it was no longer needed.

After sizing up the job, I dispatched my partner for the necessary tools, etc. While awaiting his return, I decided to get the job started — or rather the shaft stopped.

So without further thought, I picked up a broom handle and knocked off the moving belt.

Immediately I thought I was surrounded by fire sirens. Then the place began to rumble, pieces of wood began to fly in all directions.

Finally the climax came with a terrific wrench as the hangers tore loose and the shaft dropped halfway to the floor.

As I stood in the middle of a big cloud of dust, strangely quiet and devoid of people, I realized that *I had knocked the belt off the 10-in. pulley of the driven shaft instead of the driving shaft.* And the belt had dropped onto the jackshaft, causing it to try to turn at 2000 rpm . . . which, needless to say, the big pulleys and the hangers could not take.

R B MORRIS
Brecksville, Ohio
Engineering Services, B F Goodrich Co

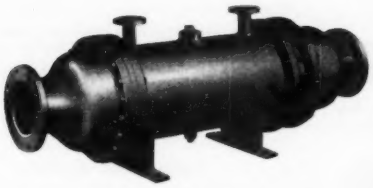
• What is your "biggest boner"? We'll pay ten dollars for each one we publish

Texas Gas Transmission Corp outlined before the Federal Power Commission plans for a $45.3 million pipeline project that will bring more natural gas to defense industries and homes in seven Midwestern states and the Appalachian area. The company asked the FPC to authorize a 600-mile pipeline expansion that would raise daily delivery capacity by 240 million cubic feet to over 900 million cubic feet a day.

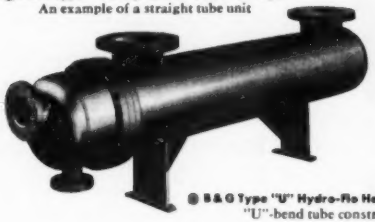
An installation of B&G Hydro-Flo Heat Exchangers and Centrifugal Pumps.

Engineered or *"Off the Shelf"*

Hydro-Flo® HEAT EXCHANGERS



B & G Type "OC" Hydro-Flo Heat Exchanger
An example of a straight tube unit



B & G Type "U" Hydro-Flo Heat Exchanger
"U"-bend tube construction

The wide utility and capacity range of B & G *Hydro-Flo* Heat Exchangers permit many requirements to be satisfied with standard, or "off-the-shelf" units. Where special design or material is necessary, the B & G engineering staff is always available for consultation and equipment can be built to your specifications.

In either case, you'll find that B & G Heat Exchangers will meet your most critical appraisal. Sound design, backed by painstaking workmanship and rigid inspection assure equipment of top efficiency and long life. *B & G Hydro-Flo Products deliver more value per dollar because they are built that way!*

Send for Catalog DM-1150, which describes B & G *Hydro-Flo* shell and tube heat exchangers, oil preheaters, oil coolers, gas coolers, water heaters, refrigeration condensers and evaporators.

B & G Centrifugal Pumps
Complete line for application in process industries and refrigeration and air conditioning installations. Send for catalogs.

BELL & GOSSETT
C O M P A N Y

Dept. CF-36, Morton Grove, Illinois

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Send for them today

• Wherever steam is used, these generously illustrated Stickle Bulletins should be on file. Because each contains valuable tips on how to cut steam costs . . . increase production efficiency. Send for any, or all—they're *absolutely free!*

Stickle Steam Traps

Four *free* bulletins provide full details: No. 115 for small capacities, medium pressures. No. 315 for large capacities, medium pressures. No. 515 for large capacities, high pressures. No. 415 for low pressures and vacuum service.

Stickle Valves

Two *free* bulletins provide full details: No. 235 for double-seated, semi-balanced regulating and reducing valves. No. 435 for single-seated, balanced valves, including spring- or lever weight-loaded and diaphragm-operated types.

Stickle Differential Drainage

Stickle Differential Drainage and Boiler Return Systems increase boiler capacities—save fuel. A closed pumping system. Full details covered in *free* Bulletin No. 250.

Stickle Open Coil Heaters

Stickle Feed Water Heaters are available in deaerating and non-deaerating types—in capacities from 3,000 to 250,000 lbs. Full details in *free* Bulletin No. 117.

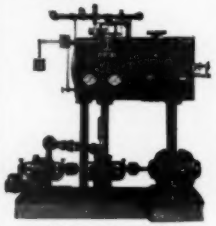
Stickle Paper Mill Equipment

Stickle makes a complete line of cost-cutting drainage and control equipment for the paper industry. Complete details are covered in *free* Bulletin No. 160. Separate Bulletin No. 600-A supplies full information on the all-new Stickle Vacuum Pump.

STICKLE STEAM SPECIALTIES COMPANY

2265 Valley Avenue • Indianapolis 18, Indiana

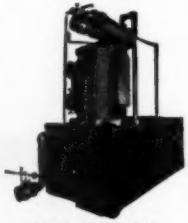
This is a partial line up of money-saving STICKLE equipment



Stickle Differential Drainage and Boiler Return System

Stickle Regulating and Reducing Valves

Stickle Open Float Steam Traps



Stickle Open Coil Feed Water Heaters

More FREE BULLETINS

Begins on page 163

may be made manual or completely automatic. Specifications, typical installations and applications given. 86-page catalog No. 830. Jeffrey Mfg. Co, Columbus 16, Ohio.

B27 COAL AND MATERIALS HANDLING EQUIPMENT—Presents a complete line of flight and belt type portable conveyors and under car unloaders for handling coal, coke, sand, gravel and other bulk materials. Specifications given on electric and gasoline powered models as well as hand-move and self-propelled conveyors. 12-page bulletin No. 512. Lake Shore Engrg Co, Iron Mountain, Mich.

B28 CONVEYOR BELT ACCESSORIES—Describes a spring-type multiple-blade belt cleaner which removes wet or dry particles from conveyor belts; and a roller type, instant acting holdback for preventing accidental reversal of inclined conveyors and elevators. 4-page bulletin No. 651. Stephens-Adamson Mfg. Co, Aurora, Ill.

B29 VIBRATING SCREENS — Describes Model UP vibrating screens for the dry-screening of light and fine materials, and Model NRM liquid vibrating screens for high speed separation of solids from liquids. 20-page booklet No. 2377. Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill.

MECHANICAL TRANSMISSION

B30 WORM GEAR SPEED REDUCERS — Descriptive of several worm gear speed reducer units such as the Type CU unit for cooling tower service, the Speedaire fan-cooled reducer used where space is at a premium, and other units designed for specific applications involving unusual problems. 8-page bulletin. Cleveland Worm & Gear Co, 3249-59 E 18th St, Cleveland 4, Ohio.

B31 ROLLER CHAINS—Offers a quick means of determining interchangeability of various makes of roller and conveyor chains. Also of value in determining proper application of chain drives as a power transmission or conveying medium. Catalog No. HD-51. Whitney Chain Co, 237 Whitney St, Hartford 2, Conn.

B32 ROLLER CHAINS AND SPROCKETS—Gives details on list prices, available sizes of types A, B, and C Morse stock sprockets, and stock roller chain from ⅜ to 2 in. pitch. Also includes data on drive selection, service factors, installation and service. Catalog No. C 55-50. Morse Chain Co, 7601 Central Ave, Detroit 8, Mich.

METALS AND ALLOYS

B33 NICKEL CAST IRONS—Presents many valuable characteristics of modern nickel cast irons and illustrates their broad acceptance throughout industry. 27 charts, tables, and photomicrographs show how through the use of nickel the engineering properties of cast iron can be controlled to meet almost any combination of service requirements. 28-page bulletin. International Nickel Co, Inc, 67 Wall St, New York 5, N. Y.

B34 STAINLESS STEELS — Presents 40 different types of Allegheny metal stainless steel and covers each type from standpoint of analyses, fabrication, heat treatment and special conditions of service. A few of the subjects include: selection of proper type of stainless; presentation of each type of stainless separately; heat resistant properties and low temperature properties of metals. 120-page cloth-bound handbook. Allegheny Ludlum Steel Corp, 2020 Oliver Bldg, Pittsburgh 22, Pa.

METERS AND INSTRUMENTS, MECHANICAL

B35 CONDENSATE METER — Explains design, construction, installation and operation of a rotary

standard HAGAN

RING BALANCE METERS

give reliable readings over the *full chart range*

The simple, radial torque principle used in Hagan Ring Balance Meters gives dependable results over the entire chart range. For example, the operator who brings a boiler onto the line can depend on the Hagan Boiler Meter to indicate the instant the boiler starts delivering steam.

Hagan Ring Balance Meters readily handle high differentials—up to 420″ of water column—which are a source of difficulty in conventional meters.

Other important features of the Hagan Ring Balance Meter include:

- ★ **No stuffing boxes**
- ★ **Ease of dead weight calibration**
- ★ **High sensitivity at low flow rates**
- ★ **Adjustable full scale range**
- ★ **Easy and inexpensive maintenance**

Clip the coupon for additional information about how Hagan Ring Balance Meters can serve you.

HAGAN CORPORATION

RING BALANCE FLOW AND PRESSURE INSTRUMENTS
THRUSTOR FORCE MEASURING DEVICES
BOILER COMBUSTION CONTROL SYSTEMS
METALLURGICAL FURNACE CONTROL SYSTEMS

HAGAN RING BALANCE METERS

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Hagan Corporation
Hagan Building
Pittsburgh 30, Pennsylvania

Please send me further information on Hagan Ring Balance Meters. I am particularly interested in .....

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POSITION .....

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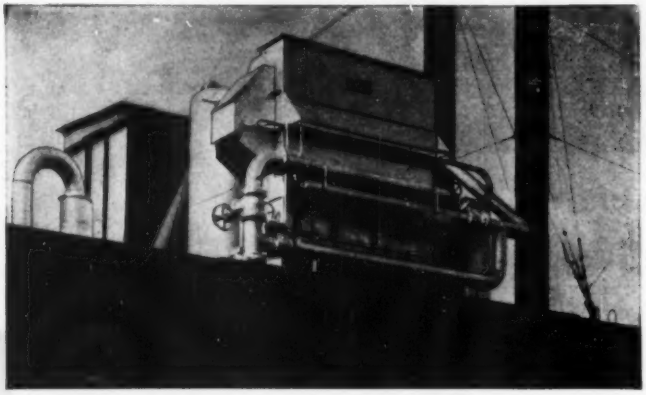
CITY ..... ZONE ..... STATE .....

P-10

Direct saving of cooling water expense returns to you the cost of a Niagara Aero After Cooler in less than two years.



How to Get Drier Compressed Air:

It prevents many troubles and saves much expense

● NIAGARA AERO AFTER COOLER cools compressed air or gas below the temperature of the surrounding atmosphere. Therefore you get no further condensation in your lines. You save much in repairs to pneumatic tools and equipment; you save much interruption to production; you save water damage in paint spraying, in air cleaning, in any process where compressed air comes in contact with your materials or parts in manufacturing (sand blasting, for example).

Niagara Aero After Cooler uses evaporative cooling, saving 95% of your cooling water consumption. This saving quickly returns the cost of the equipment to the owner or makes extra cooling water available for other processes.

The Niagara Aero After Cooler produces compressed air with 30% to 50% less moisture than by ordinary cooling methods. Other Niagara equipment provides bone-dry air for processes requiring it.

If you have an air problem or a cooling problem, a Niagara engineer probably has an answer that will improve your process or save you operating or maintenance expense.

Write for Bulletin 98

NIAGARA BLOWER COMPANY

Over 35 Years Service in Industrial Air Engineering

Dept. P, 405 Lexington Ave. New York 17, N. Y.

Experienced District Engineers in all Principal Cities

(*Advertisement*)

More FREE BULLETINS

Begins on page 163

condensate meter for determining steam consumption where all condensate can be captured. Size, dimension and weight table, and simplified piping diagrams included. 4-page bulletin No. R-513. American District Steam Co, Inc, North Tonawanda, N. Y.

B36 FLOW RATIO CONTROLLER — Describes Ratomatic flow ratio controllers, complete systems for proportioning the flow of fluids in two or more lines. Principle of operation, reasons for this improved ratio control, and typical applications are included. 8-page catalog No. 53. Fischer & Porter Co, 4600 County Line Rd, Hatboro, Pa.

B37 GAS ANALYZER AND ALARM— Contains a discussion of the GP blast furnace gas analyzer and alarm developed to measure concentration of dust in blast furnace gas, and in any type of solid suspended in air or gas. Included in bulletin is a bill of material for one gas dust analyzer; typical chart from gas-dust analyzer and recorder used in a steel mill; calibration curve chart. 16-page bulletin. General Power Plant Corp, 381 4th Ave, New York 16, N. Y.

PIPING, FITTINGS, VALVES AND SPECIALTIES

B38 SAFETY-RELIEF VALVES — Manual, "Principles of Manifold Discharge Piping Application with Farriseal and Balanseal Safety-Relief Valves," proposes an approach to the design of discharge header systems based on the partial or complete elimination of back-pressure effects on tied-in safety-relief valves. 34-page manual No. 51-B. Farris Engrg Corp, Palisades Park, N. J.

B39 STEAM TRAPS—Presents data on a trap selector for steam process equipment, industrial space heating equipment, steam generation and distribution equipment, laundry, restaurant and hospital equipment. Capacities and trap selection tables are given for each type. 20-page Bulletin No. T-1750. Yarnall-Waring Co, Mermaid Lane, Philadelphia 18, Pa.

B40 OIL STRAINERS — Contains information on Duoflo suction strainers and discharge strainers. Dimensions, capacity, sizes and list prices, are given. 4-page bulletin No. 100. Sheffler-Gross Co, Drexel Bldg, Philadelphia, Pa.

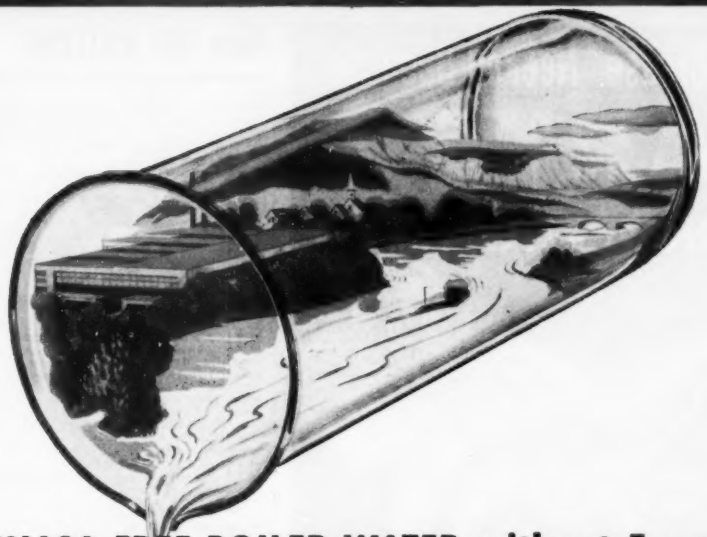
B41 STEAM TRAPS—Illustrates and describes a line of industrial steam traps, radiator traps, expansion steam traps, weight operated traps, continuous flow gasoline traps, piston operated traps, and separators. Includes capacity tables, installation diagrams, size data for specific applications. 30-page catalog No. 751. W H Nicholson & Co, 12 Oregon St, Wilkes-Barre, Pa.

B42 PURIFIERS — Illustrates and describes functions of nine types of purifiers for entrainment separation in air, steam, vapor, gas applications in power generation, petroleum refining, chemical and food processing fields. 4-page bulletin No. G-51. Centrifix Corp, 3608 Payne Ave, Cleveland 14, Ohio.

B43 VAPOR PURIFIER—Gives data on the Hi-eF internal type purifier for installations inside steam drums, flash tanks, evaporators, packed towers, bubble-cap towers, deodorizers and stills. Dimension table, specifications, and operation included. 4-page bulletin No. 100. Steam Specialty Div, V D Anderson Co, 1935 W 96th St, Cleveland 2, Ohio.

PUMPS

B44 DELIVERY PUMPS — Illustrates and describes three new constant delivery axial piston pumps for pres-



SILICA-FREE BOILER WATER without Evaporation . . .

From Any Raw Water Supply

The AMBERLITE deionization process gives you the water you *need* from the water you *have*. Regardless of water analysis, you can obtain highest quality boiler-feed water, *without* evaporation. Total ionized solids can be reduced to less than 0.1 p.p.m. Silica content, CO_2 content and hardness are virtually zero.

You'll cut costs, too, with AMBERLITE deionization. Equipment cost is small compared to evaporators. Operating cost is lower. Corrosion of piping is reduced through removal of CO_2, which is never completely accomplished by evaporation. An adequate supply of conditioned water is assured despite wide variation in the quantity required.

For improved water conditioning at lower cost, choose either an AMBERLITE multiple bed installation or a single bed unit. For further details, write today for your copy of our new four-page bulletin on AMBERLITE Ion Exchange Resins. Then discuss AMBERLITE deionization with your consulting engineer or water conditioning equipment manufacturer. He will be glad to help you select the right combination to suit your specific needs.

Newest word in water-treating

MONOBED DEIONIZATION

One pass through one column of AMBERLITE mixed anion and cation exchangers can transform raw water into deionized, silica-free water. Ask for our new 12-page booklet, "Monobed Deionization."

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square Philadelphia 5, Pa.

Representatives in principal foreign countries

AMBERLITE *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.*

Less "Elbow Grease" Needed Because

DARTS

are DROP-TIGHT!

This True Ball Joint Makes the Difference

You don't have to be a "muscle man" to tighten a Dart — they're drop-tight without excessive wrenching. That's one reason why they can be used over and over again.

Darts *last longer* because both seats are non-corrosive bronze for resilience and peak protection against corrosion and pitting. What's more, both seats are *precision machined* then *spherically ground* to a true ball joint.

Last, the nut and both ends of a Dart are *practically indestructible.* They're made from high test, air-refined malleable iron.

Because they're grief-proof in the jobs they do — Darts are grief-proof for the dealers who handle them!

DART UNION COMPANY
Providence 5, Rhode Island
The Fairbanks Co.— Distributors
Boston New York Pittsburgh

DART
UNIONS

More FREE BULLETINS

Begins on page 163

sures up to 3000 and 5000 psi. Specifications and dimensions are included. 4-page bulletin No. 46601. Oilgear Co, 1560 W Pierce St, Milwaukee 4, Wis.

B45 CHEMICAL SERVICE PUMP— Gives data on Type G medium duty chemical service pump for process and chemical plants having semi-critical requirements. Available in 1, 1½, 1¼ and 2 in. discharge sizes and heads to 240 ft. Specifications, dimensions, selection chart. Warren Steam Pump Co, Inc, Warren, Mass.

OTHER EQUIPMENT

B46 DEIONIZERS— Describes single tank deionizers of mixed-bed, monoflo design. They produce water free from all ionizable impurities including carbon dioxide and silica. Engineering and technical data covering range of sizes included. 6-page bulletin No. 512. Elgin Softener Corp, 134 N Grove Ave, Elgin, Ill.

B47 STUD WELDING— Features a step-by-step photographic explanation of how to stud weld and includes 14 photos of actual process. Also includes sections on how the weld is made; types of welds; and do's and don'ts of stud welding. 32-page pocket-size manual. KSM Products, Inc, 6512 Park Ave, Merchantville, N. J.

B48 DOOR OPERATOR—Descriptive of a new door operator, Model CA-300 series, for sectional overhead doors on service stations, garages, warehouses, commercial, industrial, public and other types of buildings. 2-page bulletin No. CA-300. Robot Appliances, Inc, 13165 Prospect Ave, Dearborn, Mich.

B49 FORCED-DRAFT FANS — Describes the design features of Prat-Daniel forced-draft fans. Also shows various types of fan-wheels and housing as well as a complete list of Thermix Corp representatives. Bulletin No. 300. Thermix Corp, Greenwich, Conn.

B50 MANUFACTURING SERVICES— Tells how Taco Heaters, Inc, a flexible and capable manufacturing organization can help solve a large design, production, or personnel problem. Firm has long experience in designing and supplying original equipment to other manufacturers for use as integral parts of their own equipment. 8-page bulletin. Taco Heaters, Inc, 137 S St, Providence 3, R. I.

B51 ELECTRICAL MEASURING INSTRUMENTS — Technical data describing Simplytrol contact meter relays, controls and pyrometers as well as API panel meters and relays. Includes sizes, ranges, prices, circuit diagrams, installation and operating instructions. 35-page catalog No. 1-A. Assembly Products, Inc, Main at Bell St, Chagrin Falls, Ohio.

B52 PUNCH AND DIE SETTING — Gives practical information regarding the application of the Cerro-matrix method of punch and die setting in making various types of dies. Illustrated with photos and drawings. 20-page manual. Cerro de Pasco Corp, 40 Wall St, New York 5, N. Y.

B53 INCINERATORS—Covers the Plibrico rubbish incinerator erected in 4 standard sizes rated at 500 to 3500 lbs per hr, and the portable incinerator in 4 sizes from 135 to 450 lbs per hr. Also described are special incinerators for garbage and cafeteria refuse, etc. 16-page catalog. Plibrico Jointless Firebrick Co, 1800 Kingsbury St, Chicago 14, Ill.

B54 DRAFTING MACHINE—Outlines advantages of a Vibax isometric-dimetric drafting machine which produces isometric and dimetric views by tracing over the lines of standard orthographic drawings. 8-page bulletin No. V-14. Indamer Corporation, 11 W 42nd St, New York 18, N. Y.

CONSIDER THESE

3 Factors

for best results in feedwater heating

Here's why you can be SURE of exactly the right feedwater heater for your particular plant conditions when you consult G-R.

1

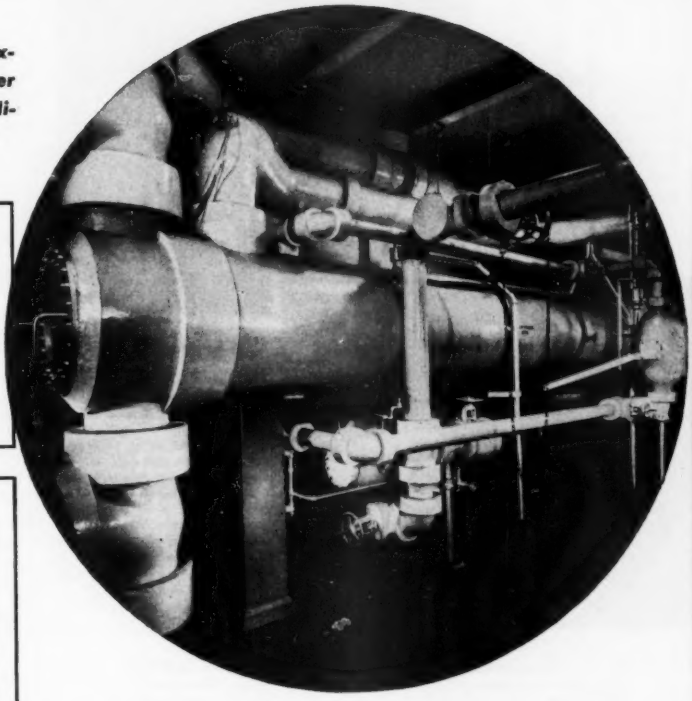
COMPLETE LINE . . . a type for every pressure and capacity . . . a selection of three designs of stationary heads . . . four designs of floating heads . . . straight-tube or U-tube bundles . . . any combination of condensing, sub-cooling, and desuperheating in a single shell.

2

EFFECTIVE DESIGN DETAILS... breech-block head for high pressure . . . pass partition sealing plates for prevention of leakage between passes . . . special baffles for steam guidance and prevention of tube erosion . . . special air and drain baffles for improving thermal efficiency.

3

60 YEARS OF EXPERIENCE in designing and building feedwater heaters . . . many hundreds of units in stationary and marine service.



This brief outline of G-R Feedwater Heaters is explained in detail in bulletin which graphically describes the many important features that are obtainable only in G-R designs. If you will write us your requirements, a copy of this informative bulletin, together with recommendations for your particular plant requirements, will be sent without obligation.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

GR 232

GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

OIL BURNERS

GAS BURNERS & ALLIED EQUIPMENT

for Power and Heat

THESE PICTURES TELL THE STORY!

Before →

A view of boiler room of large Eastern industrial plant before underfeed stokers were replaced with National Airoil Oil Burners.

← After

After installation of NATIONAL AIROIL TYPE S.A. Oil Burners under the four boilers pictured above. Note that lower front walls of the three right hand boilers have been extended. Also note angle fronts to permit firing at high ratings without impingement of flame on side walls. Either forced or natural draft may be used. Total capacity 2800 HP. Large savings were made on stoker and ash handling equipment repairs; brickwork maintenance. One operator now easily cares for all four boilers.

For 39 years—continuously since 1912—NATIONAL AIROIL BURNER COMPANY has devoted its entire efforts to the design, development, manufacture and application of successful Oil and Gas Burning Equipment. This same equipment is used throughout the U.S. and foreign countries. ➡ Many models in varied sizes are available to cover a wide scope of applications and special problems. ➡ Send us details of your plant; our engineering department will gladly offer recommendations.

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes: STEAM ATOMIZING OIL BURNERS; MOTOR-DRIVEN ROTARY OIL BURNERS; MECHANICAL PRESSURE ATOMIZING OIL BURNERS; LOW AIR PRESSURE OIL BURNERS; GAS BURNERS; COMBINATION GAS and OIL BURNERS; AUTOMATIC OIL BURNERS, for small process furnaces and heating plants; FUEL OIL HEATERS; FUEL OIL PUMPING and HEATING UNITS; FURNACE RELIEF DOORS; AIR INTAKE DOORS; OBSERVATION PORTS; SPECIAL REFRACTORY SHAPES.

NATIONAL AIROIL BURNER CO., INC.

Main Office & Factory: 1250 EAST SEDGLEY AVENUE
PHILADELPHIA 34, PA.
SOUTHWESTERN DIVISION: 2512 SOUTH BOULEVARD
HOUSTON 6, TEXAS

APPOINTMENTS

Dr Edward U Condon, noted nuclear physicist, has been appointed director of research and development of **Corning Glass Works.** The announcement by William C Decker, president, and Dr Jesse T Littleton, vice-president and present director of research and development, came with the acceptance by President Truman of Dr Condon's resignation as Director of National Bureau of Standards in Washington.

V de P Gerbereux has been appointed manager of the Centrifugal Pump Sales Division of **Worthington Pump and Machinery Corp,** succeeding A H Borchardt, who was recently elected vice-president in charge of centrifugal, reciprocating, and vertical turbine pump sales. Worthington has opened a branch office at 2nd and Locust St, Harrisburg, Pa., A. L. Mays in charge.

Westinghouse Electric Corp announces the following appointments: Harold G Cheney, sales manager for Electronic Tube Div; Richard S Sheetz, materials allocation coordinator for Lamp Div, Bloomfield, N. J.; George E Lambert, administrative assistant to Ralph C Stuart, vice-president in charge of Lamp Div; Hendley Blackmon, manager of engineering association activities for the corporation, succeeding Frank Thornton, Jr, recently retired.

De Laval Steam Turbine Co has completed a new building for sales and service activities at 160 Folsom St, San Francisco. C F Reeves will continue in charge of West Coast sales.

Donald C Minard was elected president of the **Trane Co,** La Crosse, Wis, replacing Reuben N Trane, founder, and president during the company's 38-year corporate history. Mr Trane becomes chairman of the board.

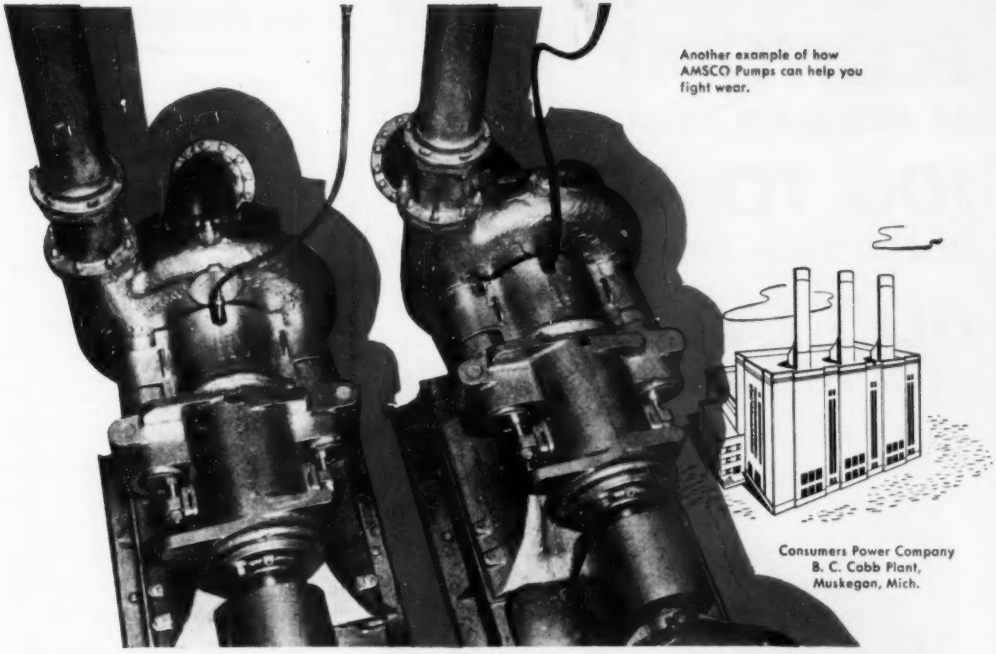
Frank H Westlake will represent **Southern Coal Co, Inc,** throughout Ohio and Michigan, specializing in coal produced by Southern's new Broken Aro mine at Wellston, Ohio.

Link Belt Co announces appointment of Roy E Lambert as assistant superintendent of its Dodge plant in Indianapolis.

The St. Thomas, Ont., works of Allis-Chalmers Rumely, Ltd, has been purchased by Canadian Allis-Chalmers, Ltd. Both firms are subsidiaries of **Allis-Chalmers Mfg Co,** Milwaukee. H Stanley Bimpson becomes consulting engineer at the general machinery division, Milwaukee. L A Watts retires as manager of the service and erection section, to be succeeded by C B Smith of the Atlanta district. C P Suykerbuyk succeeds Smith at Atlanta.

Fred McMeans and Co, 451 W Broadway, Vancouver, is exclusive engineering and sales representative for **Republic Flow Meters Co** in British Columbia. Henry Weber becomes district manager of the new Seattle district office at 1002 Second Ave, Seattle 4.

Hagan Corp, Pittsburgh, announces opening of three suboffices of their Chicago dis-



Another example of how AMSCO Pumps can help you fight wear.

Consumers Power Company
B. C. Cobb Plant,
Muskegon, Mich.

They lick their weight in ashes...4 times a day!

These AMSCO Pumps have handled 30,000 tons to date—without a replacement!

A walk through a new and modern power plant such as Consumers Power Company's B. C. Cobb plant at Muskegon, Michigan, leaves a strong impression that nothing was overlooked in designing for efficient power generation. That's why the familiar name "AMSCO" on the ash handling pumps is so significant . . . because these pumps were specified and installed by engineers who deal in cold facts . . . facts on past performance and current specifications.

Two AMSCO Pumps—working side by side for the past 2½ years—have pumped well over 30,000 tons of highly abrasive ash *without a single replacement to date.* Maintenance is simply a matter of routine inspection, consistent with good power plant management.

Any power plant can depend on AMSCO Pumps delivering this kind of trouble-free, economical performance . . . because working parts of tough, wear-resistant Manganese Steel are precision made for high efficiency and low disposal costs per ton. And, hundreds of successful installations in the past 30 years prove it!

WHENEVER YOU PUMP MATERIALS THAT CAUSE IMPACT AND/OR ABRASION . . .

. . . find out about longer-lasting, dollar-saving AMSCO Pumps. There's a size and type for every type of materials handling service . . . made by the world's largest producers of Manganese Steel castings for all industry.

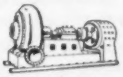
AMSCO controls impact and abrasive wear in 5 basic industrial operations:

Power Transmission

Mining & Excavating

Transportation

Crushing & Pulverizing



Materials Handling

American Brake Shoe Company

AMERICAN MANGANESE STEEL DIVISION

382 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.

ECONOMY
AT MODERATE INITIAL COST
100 TO 4000
HORSEPOWER RANGE
600# GA., 750° F.
STEAM PRESSURES

MURRAY
STEAM TURBINES
TYPE UV MULTISTAGE

The Type UV Multistage Turbine is available in from two to ten pressure stages making Multistage steam economy available at moderate initial cost. Horsepower range is from 100 to 4000, steam pressures up to 600# ga., 750° F., condensing or non-condensing. Several governors and accessories adapt UV Turbines to practically any mechanical drive within the capacity range.

Pictured is a 5 Stage UV Turbine developing 325 HP at 6200 RPM operating condensing. Turbine is equipped with variable speed oil relay governor, pressure lubrication and vacuum breaker, and is in use driving a centrifugal compressor for refrigeration.

Contact your Murray representative for prices and engineering information or write for Bulletin T-122.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY

More APPOINTMENTS

Begins on page 228

trict office: Rockford, Ill., in charge of Art Soderberg; Peoria, in charge of Wilf Chapman; Indianapolis, in charge of Otto Lessa.

Griscom-Russell Co moves its general offices from New York City to Massillon, Ohio, location of the company's plant. The New York office at 285 Madison Ave will continue to operate.

Vice Admiral (USN, retired) Willard A Kitts, 3rd, becomes manager of Ordnance engineering for **General Electric Co's** Aircraft, Federal & Marine Divisions. Edmund C Schorr is new manager of sales of the specialty transformer and ballast dept at Fort Wayne, Ind; Clifford M Dunn becomes manager of the Michigan apparatus district, succeeding Arthur R Hines, who is the new assistant manager of marketing. W F Rauber, manager of sales of the switchgear department in Philadelphia, has been named special representative of the apparatus division in Washington; Clarence E Burke, manager of sales of the specialty transformer and ballast dept, Fort Wayne, succeeds to the Philadelphia post. Zack G Taylor, assistant manager of lamp manufacturing for GE's lamp division, Nela Park, Cleveland, retires September 1.

New home office building of the **Allen-Sherman-Hoff Co** is at 259 E Lancaster Ave, Wynnewood, Pa.

Buffalo Forge Co announces retirement of Nathan R Johnson, director and factory manager, who will be succeeded by William R Heath. John E Gill takes Heath's place as chief engineer; George P Schivley is promoted to plant manager.

Babcock & Wilcox Tube Co Pacific Coast sales office moved to 1111 Wilshire Blvd, Los Angeles.

Reliance Electric and Engineering Co, Cleveland, has added the following sales personnel: Ralph D Abercrombie Jr, Buffalo; Rex T Willard, Atlanta; Merle Kip Sieber, New York; Nicholas D McKay, Detroit.

Proctor H Avon has been appointed division engineer of **Monsanto Chemical Co's** merrimac division, succeeding John S Hayes, who has been promoted to assistant director of the general engineering department in St. Louis.

Independent Pneumatic Tool Co, Aurora, Ill, has transferred its Cincinnati branch to 3726-28 Floral Ave.

Airtemp Division of **Chrysler Corp,** Dayton, Ohio, announces the following district representatives: F G Hill, Dallas; J I Bickley, Washington, D.C.; J J Casey, St. Louis; C A Palmer, Chicago; and W Brawner and D M Thomas, Detroit.

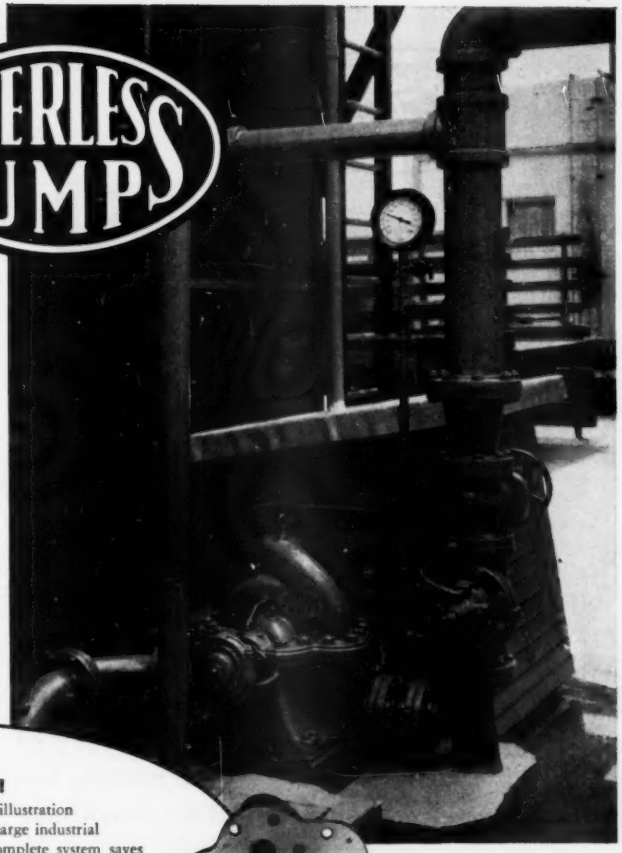
A new company, the **Ajax Electric Motors Co,** 200 Troup St, Rochester, N. Y., will serve as world-wide distributors for

PEERLESS Type TU

MULTI-STAGE PUMPS for HOT and COLD LIQUIDS

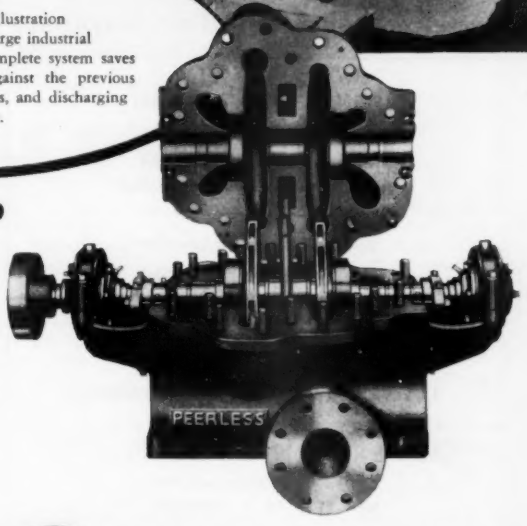
A PLUS in Performance without a premium in price

When moderate capacities and high heads are involved in handling cooling tower water, boiler feed applications, and process liquids, Peerless Type TU pumps will exactly meet your needs. They provide capacities from 50 to 2,500 gpm, head ranges from 250 to 1600 feet and discharge sizes up to 10 inches. The low loop cross-over is cast integral with the top half of the pump case in sizes 4 inches and smaller. Excellent efficiencies and a great number of superior design features that effect long life with minimum downtime provide a performance plus at no extra cost.



MAKING RECORDS!

The Peerless Type TU pump in the illustration operates on a cooling tower system for a large industrial plant. According to their engineers, this complete system saves them over $550.00 every month, as against the previous method of using water from city mains, and discharging into the sewers after one use.



DEPENDABLE, DURABLE AND RUGGED DESIGN AND CONSTRUCTION . . .

Here are a few features of Type TU construction:

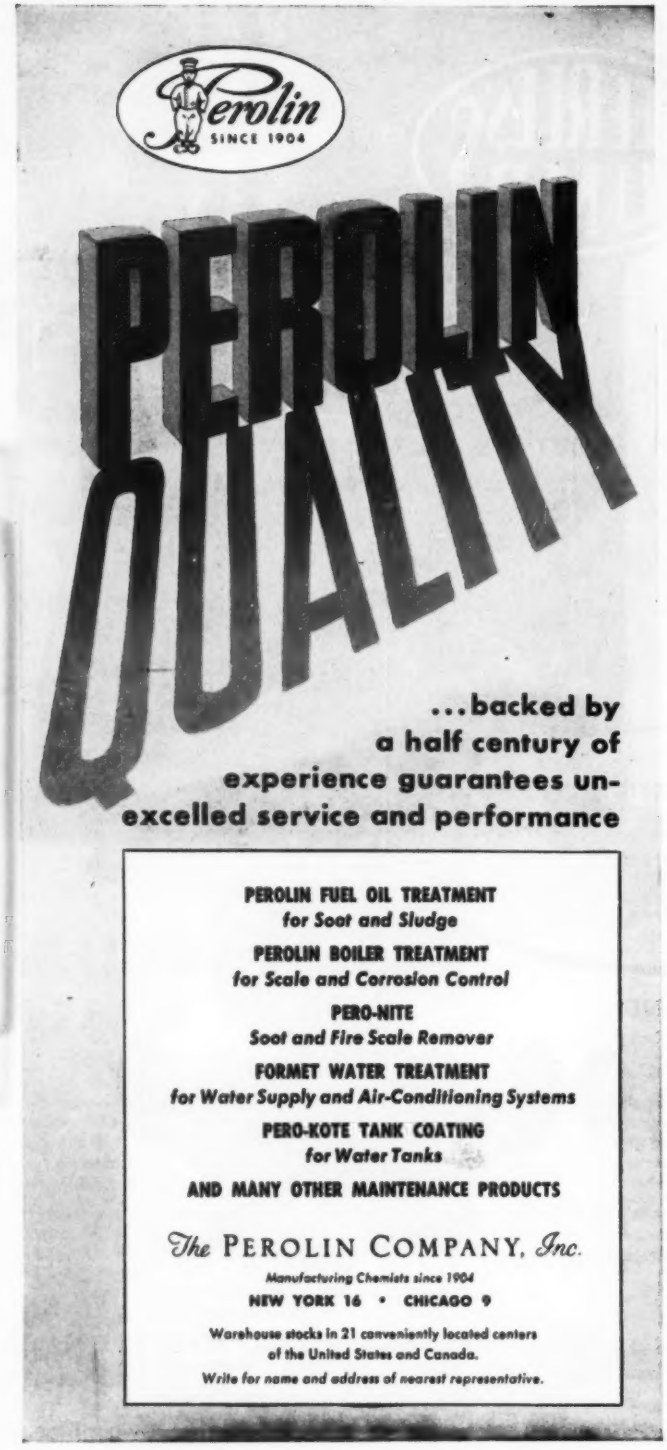
Equipped with duplex angular contact thrust bearings, water cooled bearing housings, heavy stiff case rings, sleeves locked against impeller hubs, in-and-out cooling and sealing connections at stuffing box.

High pressure stuffing box on these pumps is under one stage pressure only, regardless of the net pressure developed by the pump.

Spacer bushings between stages are serrated with grooves throughout its length, are longer than competitive pumps, thus making an effective seal between stage pressures.

The Peerless Type TU pump is described in Bulletin B-301. Write for your copy today.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Address inquiries to Factories at:
Los Angeles 31, California and Indianapolis 8, Indiana
Offices: New York, Chicago, St. Louis, Atlanta; Dallas, Plainview and Lubbock, Texas; Fresno; Los Angeles; Phoenix; Albuquerque, New Mexico.


Perolin
SINCE 1904
PEROLIN QUALITY
...backed by a half century of experience guarantees unexcelled service and performance
PEROLIN FUEL OIL TREATMENT
for Soot and Sludge
PEROLIN BOILER TREATMENT
for Scale and Corrosion Control
PERO-NITE
Soot and Fire Scale Remover
FORMET WATER TREATMENT
for Water Supply and Air-Conditioning Systems
PERO-KOTE TANK COATING
for Water Tanks
AND MANY OTHER MAINTENANCE PRODUCTS
The PEROLIN COMPANY, Inc.
Manufacturing Chemists since 1904
NEW YORK 16 • CHICAGO 9
Warehouse stocks in 21 conveniently located centers of the United States and Canada.
Write for name and address of nearest representative.

More APPOINTMENTS

Begins on page 228

new electric motors, control equipment and transformers. David Lipsky is president.

Conduit Nipple Mfg Co announces the election of J Clifton Vandermast to vice-president in charge of sales.

G F Vietor Jr, has been appointed Houston district manager of **Air Reduction Magnolia Co,** division of Air Reduction Co.

S D Andrews has been appointed branch manager of the Dallas office of **General Controls Co.** Joseph Fallon becomes factory branch office manager for Columbus, Ohio. Richard Grayson takes over as general manager of the newly formed Grayson-Greenamyer Appliance Controls Div Plant, following General Control's purchase of the assets of Grayson-Greenamyer, Inc., of Monrovia.

Yale and Towne Mfg Co announces that John T McCarley has been promoted to assistant general manager. Kenneth H. Bergstrom succeeds him as manager of production at the Philadelphia division, which manufactures the Yale line of hoists and industrial trucks.

Barton K Wickstrum becomes vice-president and director of sales of **Sylvania Electric Products, Inc,** succeeding Robert H Bishop, who has resigned to become a vice-president of E F Drew & Co, Inc, New York. Charles A Burton succeeds Wickstrum as general sales manager of the lighting div.

American Structural Products Co, a subsidiary of Owens-Illinois Glass Co, has appointed Richard J Canavan district sales manager in Washington, D. C., for Insulux glass block.

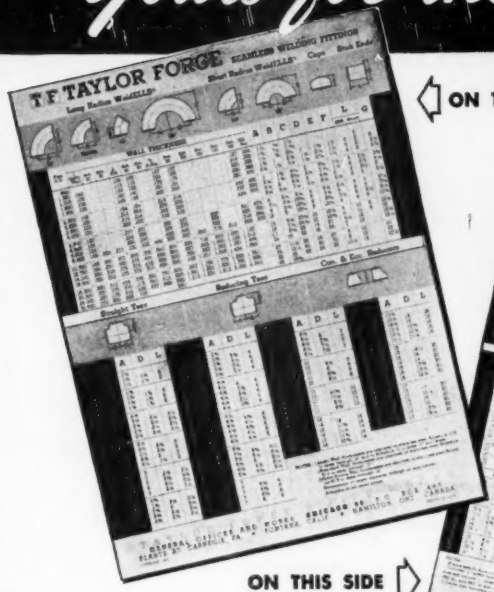
Canadian operations of the **Wheelco Instruments Co,** Chicago, will be handled by their new Canadian subsidiary, Wheelco Instruments of Canada, Ltd, under the direction of Francis Beaupre, with offices at 601 Merton St, Toronto 12. The firm will have the sales and service assistance of three district agencies: Lachapelle & Archambault, Ltd, Montreal; Wells H Morton Co, Ltd, Calgary; Instrument Service Laboratories, Vancouver.

Austin L Hawk becomes assistant manager of the Western sales district, Manhattan Rubber Div of **Raybestos-Manhattan, Inc,** 445 Lake Shore Drive, Chicago. S V V Hoffman is regional manager of the West Coast sales division for Southern California, 4651 Pacific Blvd, Los Angeles. A N Johnston Jr is assistant manager of Central sales district, Manhattan Rubber Div, 810 Empire Bldg, Pittsburgh; D H Cottrille is regional manager at Clarksburg, W. Va.

J P Orchard succeeds E C Marsh as president of the Fort Wayne division of **Bowser, Inc.**

Electric Products Co, Cleveland, announces that Harold J Thompson has joined their Chicago agency, specializing in syn-

Yours for the asking—



ON THIS SIDE – Data on the WeldELL line

ON THIS SIDE

– Data on Taylor Forged Steel Flanges

A VOLUME OF DATA

. . . covering welding fittings and forged steel flanges . . .

ON A SINGLE SHEET

Here is just about the handiest tool ever devised for the pipe designer. Data on welding fittings and flanges that otherwise could be found only by plowing through many catalog pages and tables have been ingeniously condensed on the two sides of the durable letter-size card illustrated above.

One side covers the broad WeldELL line of Taylor Forge welding fittings. For every nominal pipe size, ½" through 30", it shows the wall thickness for every weight of every fitting in every available material. It also shows all required dimensions of all types of fittings.

The other side covers the world's most complete line of forged steel flanges. For every nominal pipe size, ½" through 24", it gives all essential dimensional and bolting data for all types of flanges in all weights. A particularly useful table (see reproduction) is that showing welding neck flange bores which enables you to determine the I.D. of any nominal pipe size without separate calculation. Thus the sheet gives you O.D. and I.D. of any weight of pipe.

The card is varnished to make it stand the steady usage you are certain to give it. To obtain your copy see your Taylor Forge distributor or **MAIL THE COUPON.**

T F

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS

General Offices and Works: P. O. Box 485, Chicago 90, Ill.
Offices in all principal cities.

Please send me one of your fitting and flange sheets:

NAME_____

POSITION_____

COMPANY_____

STREET ADDRESS_____

CITY_____ ZONE____ STATE_____

501-1051 Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

TUBES FOR BENT AND STRAIGHT TUBE BOILERS

COIL AND SPECIALTY BENDING

IDEAL FLUE TOOLS

STEEL AND COPPER FERRULES

BOILER TUBE CO. OF AMERICA

McKEES ROCKS, PA.
(Pittsburgh District)

PITTSBURGH
CHICAGO

FRED S. RENAULD & CO.,
LOS ANGELES

HENSZEY

PACKET-TYPE *Automatic*
CONTINUOUS BLOWDOWN

- Prevents PRIMING
- Prevents FOAMING
- Prevents SLUDGE
- Prevents SCALE

(with simple chemical treatment)

This compact self-contained unit is completely assembled. Can be installed by your own men in hours. It provides completely automatic control of boiler water concentration regardless of variations in boiler load. This is accomplished WITHOUT HEAT LOSS. Maintain clean efficient boilers for substantial savings in fuel, equipment and manpower.

Also...
Standardized or special units for ALL CAPACITIES.

HENSZEY

Consult your nearest HENSZEY Representative for FREE Blowdown Chart or write to

HENSZEY COMPANY
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CONTINUOUS BLOWDOWN and BOILER PLANT SPECIALTIES
Boiler Feed Regulators • Distillation Systems • Heat Exchangers • Feed Water Meters
Flow Indicaters • Proportioning Valves
Also MILK EVAPORATORS and PREHEATERS

More APPOINTMENTS

Begins on page 228

chronous and induction motors, ac and dc motors and generators, electrolytic power supplies and frequency changers.

Fluor Corp, Ltd, Los Angeles engineers and constructors, announces the creation of a new defense products engineering dept, to be headed by M R Born.

Graver Water Conditioning Co announces appointment of Harold R Fosnot as Eastern sales manager with headquarters at 216 W 14th St, New York. Replacing Fosnot in Chicago is Herman M Ross, previously Cleveland district manager. Richard E Lewis replaces Ross in Cleveland.

Irving Quinn, **Liberty Engineering Co,** 120 Liberty St, New York, announces admission to partnership of Emil Gruenberg, formerly head mechanical and chemical engineer of Design Service Co.

Robert H Walker, former manager of the South Hadley, Mass., electric light dept, has been appointed assistant to the president of **Holyoke, Mass., Water Power Co,** in charge of power operations.

Harold D Resseguie has been appointed chief engineer of the **Public Service Co of New Hampshire,** with headquarters at Manchester.

Whitney Chain Co, Hartford, Conn., announces removal of their San Francisco and Northern California district sales office to 70 Dorman Ave, San Francisco. The office is under the direction of George F Haag.

American Engineering Co announces the appointment of Ralph C Davis to sales manager of their power plant division in Philadelphia. Paul N Dotzenroth succeeds Davis as district manager in Chicago.

Wallace Clark & Co, Inc, consultants, announce the appointment of Wm J McCudden as assistant to the president.

Wm B Pierce has been elected vice-president of **Allegheny Ludlum Steel Corp.**

OBITUARIES

Wendell L Bowen, sales engineer in New England for the Alken-Murray Corp, and past president of the New England States Power Engineers, died Aug 5 at Providence.

Sidney Hosmer, former vice-president and general manager of the Boston Edison Co, died Aug 27 in New York.

Harvey S Vassar, retired head of the Public Service Gas and Electric Co laboratory in Maplewood, N. J., died Aug 31 at Bloomfield, N. J. He was a former president of the ASTM.

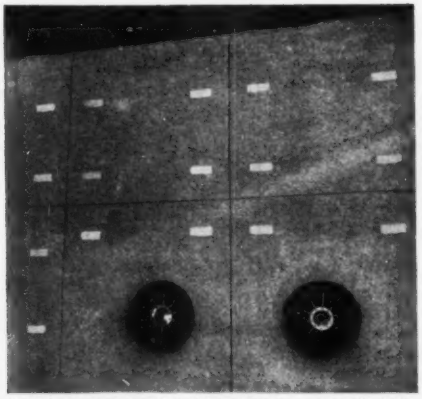
Sidney W Kitson, manager of the public works division of Worthington Pump and Machinery Corp, died Aug 28 in Boston.

A. P. GREEN
Plastic Firebrick

GIVE LONGER, TROUBLE-FREE SERVICE . . . OFFER YOU 5 ADVANTAGES

1. JOINT-FREE FURNACE LININGS
   present a solid monolithic front to slag and furnace gases.
2. ELIMINATION OF AIR INFILTRATION
   lowers fuel cost and increases efficiency.
3. ADAPTABLE TO ANY THICKNESS OR CONTOUR
   eliminating need for special refractory shapes.
4. FREEDOM FOR EXPANSION AND CONTRACTION
   with A. P. Green floating anchors.
5. "ZONE-RATED" TO DO THE JOB
   Plastics with properties to meet conditions in various zones of the furnace.

A. P. GREEN PLASTICS are firebrick in plastic, moldable form . . . shipped ready to install. Plastics are used for one-piece, monolithic linings and patching material in all types of boilers and industrial furnaces.



A. P. Green plastic firebrick lining in 821 h.p. water tube boiler. Plastic, air-cooled, sectionally supported walls were used throughout the furnace section.

The large warehouse stocks maintained by our distributors, plus their experienced engineers and installation men, are your assurance of the most advanced refractory service available.

For additional information, write for our Plastic Firebrick Folder, or call your local distributor . . . he's listed in the yellow pages of your telephone directory.

A. P. GREEN FIRE BRICK COMPANY
Mexico, Missouri, U. S. A.
In Canada:
A. P. GREEN FIRE BRICK CO., LTD.
Toronto 15, Ontario

3 TYPES TO MEET SPECIFIC REQUIREMENTS

SUPER-PLASTIC

1. Super duty plastic made from finest Missouri flint fire clays—gives exceptional service . . . particularly in furnace sections most subjected to wear as a result of high temperatures, slagging, or load under soaking heat. Superior in resistance to high temperatures, spalling, slagging, and excellent in load bearing strength.

SUPER HYBOND

2. Special super duty plastic that develops high strength throughout its entire thickness . . . regardless of furnace operating temperatures or total thickness of the lining. The back or cool portion against casing will form strong bond when enough heat has been applied to dry the plastic.

PLASTIC QUIK-PAK

3. High duty plastic made from first quality Missouri fire clays. Excellent in resistance to spalling . . . high load bearing strength . . . low service shrinkage. Specify for complete monolithic furnace linings and patching material for quick repairs . . . where furnace conditions do not require a super duty plastic.

DISTRIBUTORS IN THE PRINCIPAL CITIES OF THE WORLD

For HIGH Quality, LOW Cost

Ask Littleford about Breechings and Ducts

They all look alike to Littleford . . . big jobs and little jobs, in any shape and in any weight of metal. Highly skilled craftsmen get the utmost out of modern facilities for shearing, punching, bending, rolling and welding. Give that next job of yours the benefit of Littleford's 68 years of engineering all kinds of powerhouse fabrications . . . send your blueprints for our quotation.

FABRICATORS OF PLATE AND SHEET METALS

LITTLEFORD

LITTLEFORD BROS., INC.
438 E. Pearl St., Cincinnati 2, Ohio

DUCT WORK—BREECHINGS
ELECTRICAL ENCLOSURES—STACKS
TRANSFORMER HOUSINGS—TANKS
CONTROL DESKS—INSTRUMENT PANELS
CUBICLES—PIPING—CABLE PANS

GOOD PACKINGS must start with the TANNING

To make Rhoads Tannate Leather Packings a wide variety of specially developed packing leathers are used. These have been tanned by our own process, the culmination of nearly 250 years of producing fine leathers. Skilled craftsmen, long experienced in packing manufacture and application precision mold and custom finish Rhoads Packings to meet your exact requirements and specifications.

U—VEE—CUP—FLANGE

RHOADS Tannate® LEATHER PACKINGS

Specify Rhoads Tannate Leather Packings for more dependable service, increased production and lower costs. Write for details.

PRODUCERS OF FINE LEATHER FOR 249 YEARS

J. E. RHOADS & SONS

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BELMONT GASKETS

SEAL BETTER
LAST LONGER

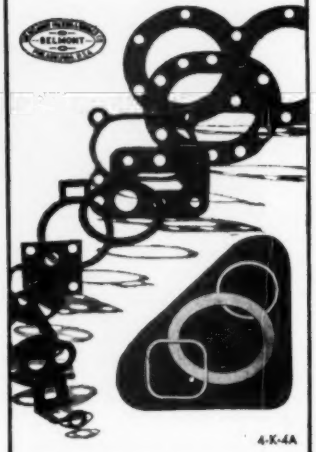
MOLDED, FORMED, EXTRUDED,
DIE OR LATHE CUT...

in sizes, shapes, and forms to meet every requirement. You can get Belmont standard and special design gaskets made of compressed asbestos, woven asbestos metallic, red rubber, cloth inserts, black rubber, vegetable fibre, cork-vegetable fibre, gray rubber, neoprene, and a wide variety of compounded materials.

And, Belmont complete manufacturing facilities assure dimensional accuracy, uniform thickness and top quality finish.

Whether your gasket problem is... temperatures... pressure... vibration... shock... oxidation... corrosion... creep... reduction or just a matter of gasket size and shape, if you want BETTER JOINT AND SURFACE SEALING... longer gasket service life—TRY BELMONT.

Distributors located in every large industrial center to serve you. Write for catalog #40.



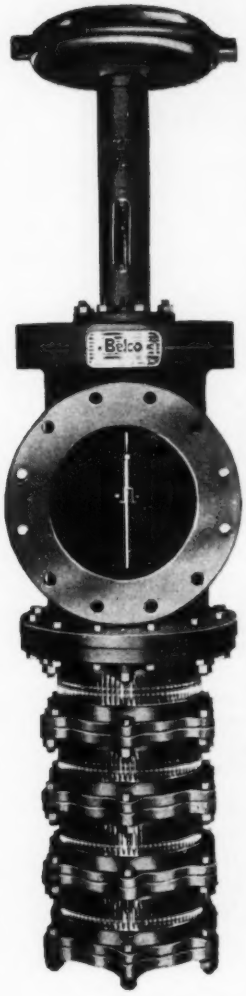
4-X-4A

...And, there's a Belmont Packing for Every Service.

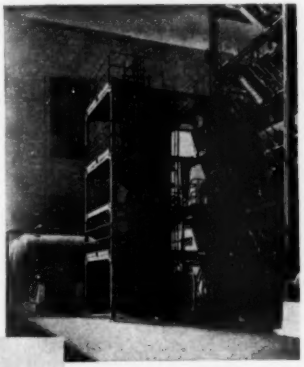
THE BELMONT PACKING AND RUBBER CO.
Butler & Sepviva Sts.
Philadelphia 37, Pa.

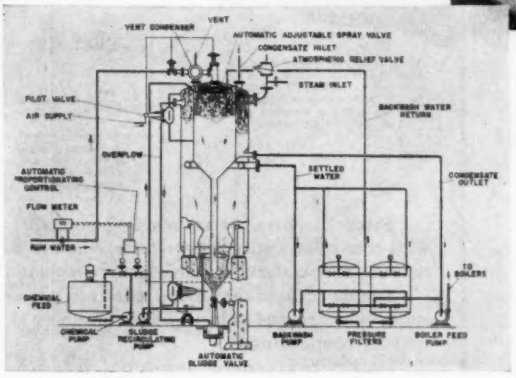
for STEAM, WATER, OIL, GAS, AIR, ACIDS, ALKALIES, AMMONIA.
RINGS, SPIRALS, COILS, REELS, SPOOLS, SHEETS, GASKETS.

The exclusive Belco Automatic Atomizing Valve Performs a Superior job in HOT PROCESS SOFTENERS



Yes, the Belco Valve, by dividing influent water into finely atomized droplets insures practically instantaneous heating on contact with the steam atmosphere. Thus elimination of 95% of the dissolved oxygen and all free carbon dioxide is accomplished. Excellent results have been attained with the Belco valve and numerous installations stand as proof of its maximum efficiency. We would like to tell you more. The types of jobs we design and build—the customers we design and build for. Call us next time you consider equipment for the removal of water impurities. We're sure we can help you to your advantage.





You may be interested in Bulletin 103, it describes Belco Heaters, Deaerators & Hot Process Softeners.

Belco

Processes for Removal of Water Impurities

BELCO INDUSTRIAL EQUIPMENT DIVISION, INC.

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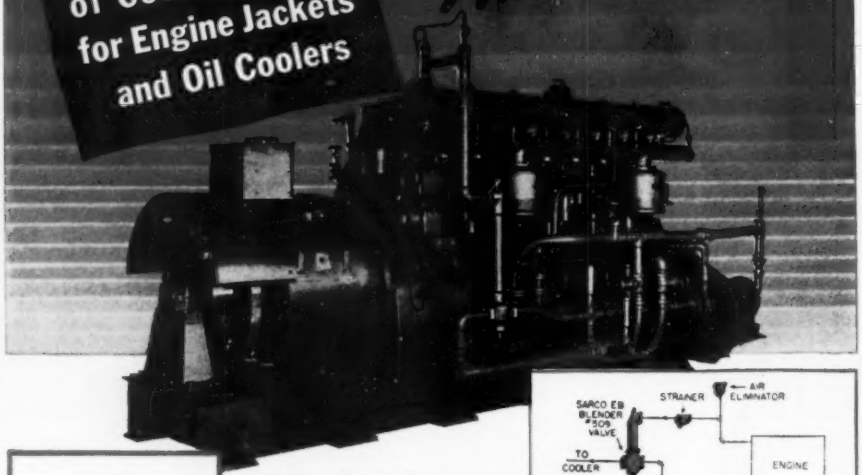
HEADQUARTERS FOR AUTOMATIC CONTROL OF ALL WATER CONDITIONING PROCESSES • AUTOMATIC CHEMICAL PROCESS CONTROLS • WATER SOFTENERS: Hot Lime Soda, Belcolite, Gravity and Pressure Types, Automatic and Manual • **FILTRATION EQUIPMENT:** Gravity and Pressure Filters, Automatic and Manual Filters, Siliceous and Non-Siliceous Filters, Iron, Oil, Taste, Odor and Color Removal Filters • **SWIMMING POOL PURIFICATION EQUIPMENT:** Automatic and Manual • **DIATOMACEOUS EARTH FILTERS • COAGULATION EQUIPMENT:** Slow and Rapid Mix Agitators (Adjustable variable speed) Setting Tanks, Sludge Removers • **SPECIAL EQUIPMENT:** Deionized (Equivalent to Distilled) Water Equipment, Silica Removal Equipment, Boiler Feed Water Heaters, Deaerators, Degasifiers, Chemical Dry Feeders, Chemical Pressure Feeders, Oil Separators (Refining process type)

IN CANADA: BOGUE ELECTRIC OF CANADA, LTD., 1405 BISHOP STREET, MONTREAL, QUEBEC

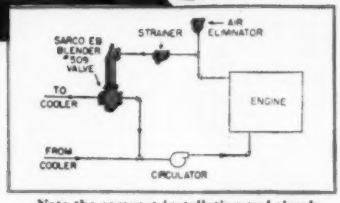
Constant Temperature...

of Cooling Water for Engine Jackets and Oil Coolers

Automatically



Atlas Imperial Diesel Engine, equipped with Sarco type EB blender to maintain constant jacket water temperature by re-circulating a varying portion of the cooling water.



Note the compact installation and simple piping. Also shown are the Sarco air vents and strainers which are necessary for efficient operation of the cooling system.

Sarco type EB Self-contained Water Blender, with built-in liquid-expansion thermostat for re-circulating control.

Sarco Blenders, by maintaining constant cooling water flow with controlled outlet temperature, insure rapid warm up, correct running temperatures and minimum temperature rise.

Simple, dependable Sarco controls prevent over-cooling or under-cooling, thus reducing wear on liners and rings, caused by cylinder condensation.

Smaller temperature fluctuations reduce stress and result in longer operating life and less maintenance.

Controlled Lube Oil temperature assures efficient lubrication.

Full information in Bulletin 702, sent free on request.

347

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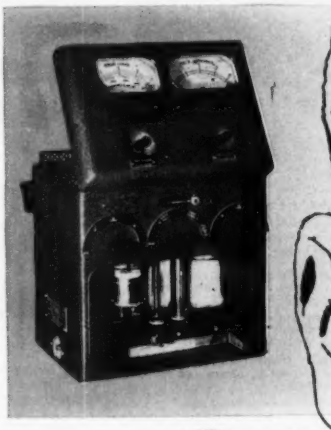
REPRESENTED IN PRINCIPAL CITIES

Not an instrument you buy... but a service we supply



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LEFFEL

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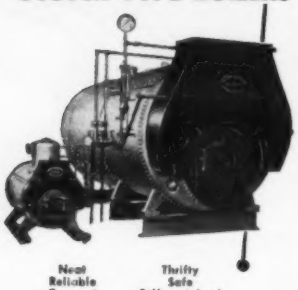

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Leffel offers you the exact boiler to suit your plant need. Available in conservative ratings of 6 through 250 actual horsepower, Leffel boilers are built to take substantial overloads. And the savings on fuel will amaze you. Where boiler room space is at a premium, a compact Leffel is the answer. COAL, GAS or OIL fired; easy to convert from one type of fuel to another. (For stoker firing, the specially designed Leffel Underfeed Stoker may be used). Before you buy a boiler, it will pay you to get the facts on the line of Leffel Scotch Type Boilers.

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established 1862

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safety steps

"A STRONG STEP TO SAFETY"

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SAFE—checker plate nosing bars make each step stand out clearly. Abrasive edging also available.

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Sales Representatives in Principal Cities

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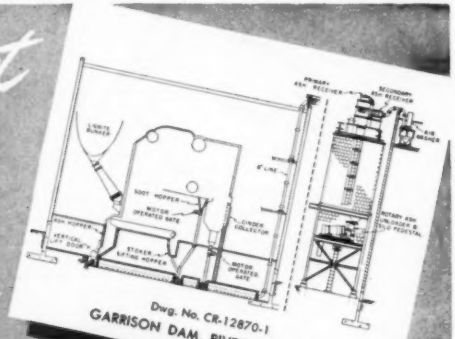
Beaumont

SOLVES LIGNITE ASH HANDLING



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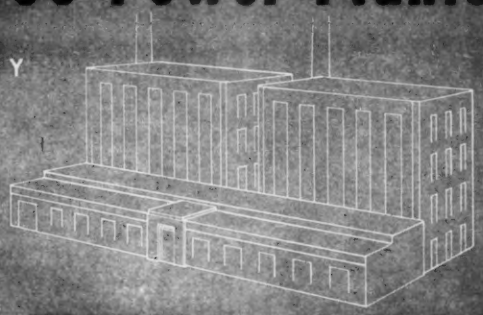

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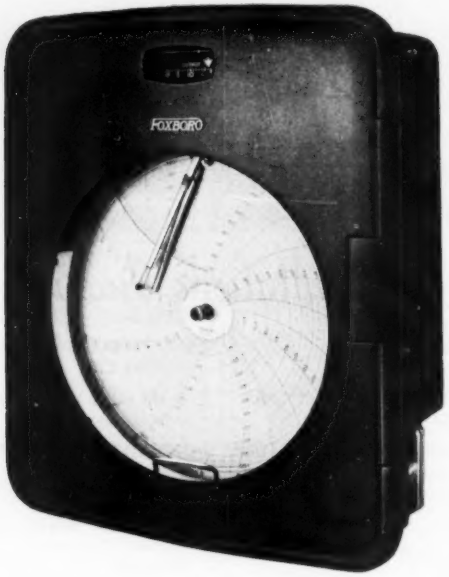
better measurement and control of

LIQUID LEVEL



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Nicholson Expansion Steam Traps

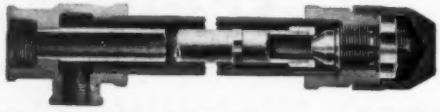
SAVE $155 PER UNIT

for Large Processor

Because of their positive effectiveness in temperature control work, Nicholson expansion steam traps, at about $35 each, are being installed by a leading processor in place of temperature controls. These were costing them $110.00 to $200.00, with cost of a trap added. Per installation, the saving is about $155.00.

Easily adjusted to pass condensate at any temperature below 212°F.

Because there is only one moving part, remarkably low maintenance costs are being shown. Easily installed, usually without supports. Lengths, 9" to 40". Pressures, 0 to 250 lbs. No air binding.



This firm is finding an increasing number of applications on tanks, stills, heating radiators, etc., where Nicholson expansion steam traps are serving as both trap and temperature controller.

For All Equipment Using Steam or Hot Water

Radiators
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Paper Machinery
Pipe Coils
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Natural Graphite licks

"EXTRA TOUGH"

lubricating jobs!

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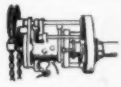
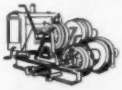

SOOT BLOWERS high temperature

BUCKETS exposure to weather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And it retains its ability to expand and contract with every variation of temperature and moisture.

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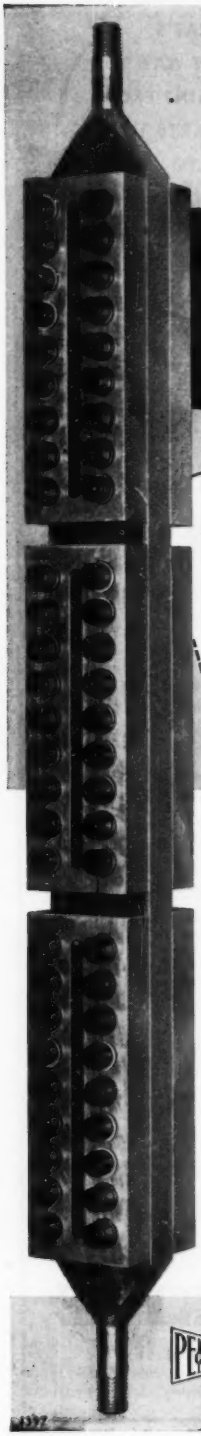

for operating pressures up to

10,000 psi

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Another PENBERTHY First

Patent Applied for

These gages were developed by Penberthy in answer to persistent demands from the process industries and various laboratories for a gage with UNOBSTRUCTED VISIBILITY at service pressure ratings up to 10,000 psi. They are tested to 15,000 psi. Temperature rating is 250° F dry gas . . . 300° F wet gas.

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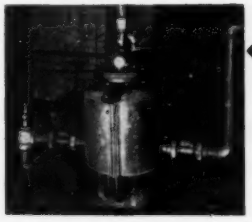

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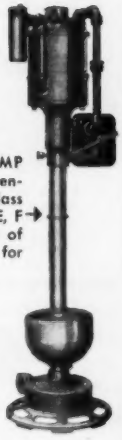
PENBERTHY EJECTORS. A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Ask for Bulletin 5080.



PENBERTHY ALSO MANUFACTURES A COMPLETE LINE OF LIQUID LEVEL GAGES IN BRONZE, IRON, STEEL AND ALLOYS

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DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

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Established 1886 *Canadian Plant, Windsor, Ontario*

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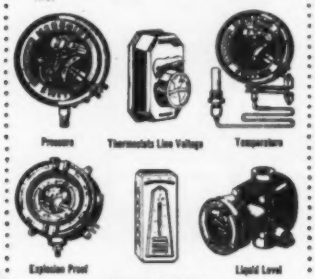
THE ONLY 100% MERCURY SWITCH EQUIPPED CONTROLS

The distinguishing feature of Mercoid Controls is the exclusive use of Mercoid hermetically sealed mercury switches. These switches are not subject to dust, dirt or corrosion, thereby assuring better performance and longer control life.



If you have a control problem involving the automatic control of pressure, temperature, liquid level, mechanical operations, etc., it will pay you to consult Mercoid's engineering staff—always at your service.

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Division of American Radiator & Standard Sanitary Corporation

WHAT'S THE BEST WAY TO STRIP PAINT FROM METAL PARTS TOO LARGE TO BE SOAKED IN TANKS?

See Page 3

Oakite's New FREE Booklet on Paint Stripping

answers many questions that will lead you to better stripping procedures. You'll want to read more about:

What's the best way to strip large areas of structural metal where a steam supply is available? *See page 5.*

What is the best method when steam is not available? *See page 7.*

What is the cheapest way to strip metal parts in large volume? *See page 9.*

What are the best ways to prepare stripped surfaces for repainting? *See page 11.*

What strippers are best for removing oil-base paints? . . . Synthetic enamels, alkali-resistant plastics or resin-based paints? . . . Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas? *See page 12.*

FREE For a copy of "How to STRIP PAINT" write to Oakite Products, Inc., 23A Thames St., New York 6, N. Y.

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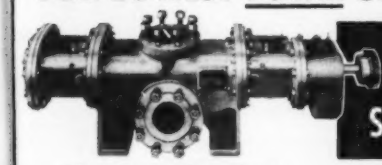
Technical Service Representatives Located in Principal Cities of United States and Canada

PUMP ABRASIVE MATERIALS?

FOR LOWEST TOTAL COST, Specify...



Sier-Bath SCREW PUMPS

● Pump shown: new External Gear & Bearing Bracket Type for non-lubricating fluids, semi-fluids. Capacities 1-700 GPM; Discharge 1000 PSI for viscous liquids, 300 PSI for water.

ROTORS INEXPENSIVELY REPLACED

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Founded 1905 Member A.G.M.A.

BEST BUY FOR PUMPING COAL TAR, ADHESIVES, SOAPS, CRUDE OILS, ETC.

In selecting pumps for abrasive materials applications, be sure to consider *total* cost. Sier-Bath Screw Pumps—though their original cost is higher than gear pumps—in the end cost *less*. The reason: considerably lower maintenance costs. Major over-hauls are simple, inexpensive. They thus enable you to keep your installation running at top efficiency—*without* sky-rocketing your pump costs.

Sier-Bath Screw Pumps are available in horizontal or vertical construction, corrosion resistant alloys. Special bodies, stuffing boxes and bearings for high temperature applications. Sier-Bath "Gearex" Pumps for lower pressures and capacities.

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Sier-Bath GEAR and PUMP CO., Inc.

5254 HUDSON BLVD., NORTH BERGEN, N. J.

Also Manufacturers of Sier-Bath Gear Couplings and Precision Gears

All These Were Once

DUST COLLECTION PROBLEMS, TOO

48 Carbon Black Plants

203 Metallurgical Installations

205 Acid Plants

40 Paper Mills

270 Detarring Installations

216 Power Stations

73 Steel Plants

99 Oil Refineries and Miscellaneous Installations

Your electrical precipitator installation will be individually engineered...and based on the Research Corporation's *experience* graphically shown by that towering pile of thousands of blue prints.

This knowledge is a valuable asset that will help Research engineers to "tailor-make" your Cottrell installation. For example, they can more quickly determine the right answers to such variables as the size, shape and type of both discharge and collecting electrodes, their relative spacing, flue arrangements and many other factors. At Research you can count on *profitable solutions to individual problems.*

In hundreds of power plants today, Research Corporation Cottrells are collecting 90% to over 99% of fly ash from pulverized fuel boilers. Write for your free copy of an informative booklet giving valuable data on these installations.

RC-118

Typical One Day Collections:

250 TONS OF FLY ASH • 6 TONS OF SODA SALTS AT A PAPER MILL • 25 TONS OF SODIUM SULPHATE AT A KRAFT MILL • 6 TONS OF BLAST FURNACE DUST

RESEARCH CORPORATION

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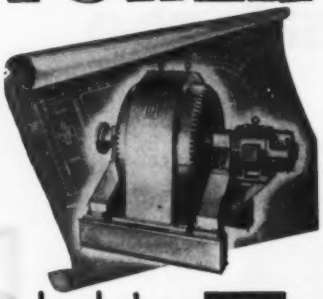
for
custom-engineered
POWER



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Since 1909, the job of The Electric Products Company has been to create and develop special electrical rotating equipment . . . motors and generators to do existing jobs better or to reach into new fields to do jobs that couldn't be done before. The natural "by-product" of our more than 40 years of specialization is that you get equipment designed and built to the exact requirements of your application . . . equipment that has greater dependability, longer life and that requires less maintenance.

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Attach coupon to your letterhead for your copy of Bulletin 2-200.

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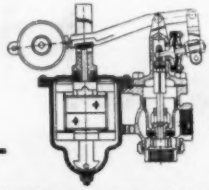
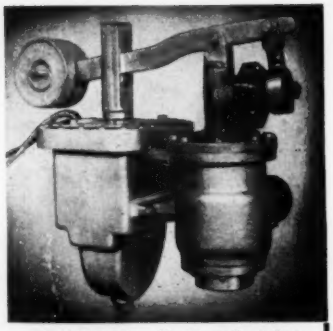
SOLENOID VALVES





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COMPLETELY SEALED VALVE MECHANISM. Valve stem is connected to solenoid lever through patented "DIA-BALL" packless joint. Widely favored for handling inflammable or toxic gases or liquids.

SELF-CLEANING DESIGN. Can be used successfully for handling heavy, sticky materials because the valve interior is simple, port area large, and outlet downward, thus taking advantage of natural gravity flow. Note that valve seat is accessible for cleaning.

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RENEWABLE VALVE DISC. Supplied with composition or metal disc to suit particular requirements. Wide choice of materials available for valve and trim.

VISIBLE ACTION. Note that valve action is visible and can be tested by hand. In an emergency the valve can be manually operated.

Ask for recommendations

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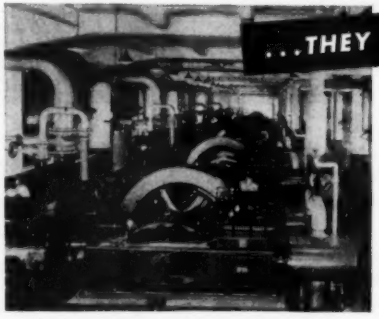
LEADING PUMPS AND COMPRESSORS HAVE

Manzel **FORCE FEED LUBRICATORS**



. . . THEY NEVER FORGET

Worthington Compressors in an automobile plant, with Manzel Model 94 Lubricators

Why it Pays to Select Manzel Lubricators

- **THEY LENGTHEN THE LIFE OF MACHINERY**
- **THEY ARE AUTOMATIC AND TROUBLE-FREE**
- **THEY ELIMINATE "DOWN TIME"**
- **THEY CORRECTLY LUBRICATE EACH POINT**

● Manzel lubricators supply each wearing point with exactly the amount of oil it needs, and *no more.* Thus they reduce oil consumption as much as 90%.

"Manzels" are furnished as standard equipment on leading makes of engines and machinery. Or they can be installed on your present equipment.

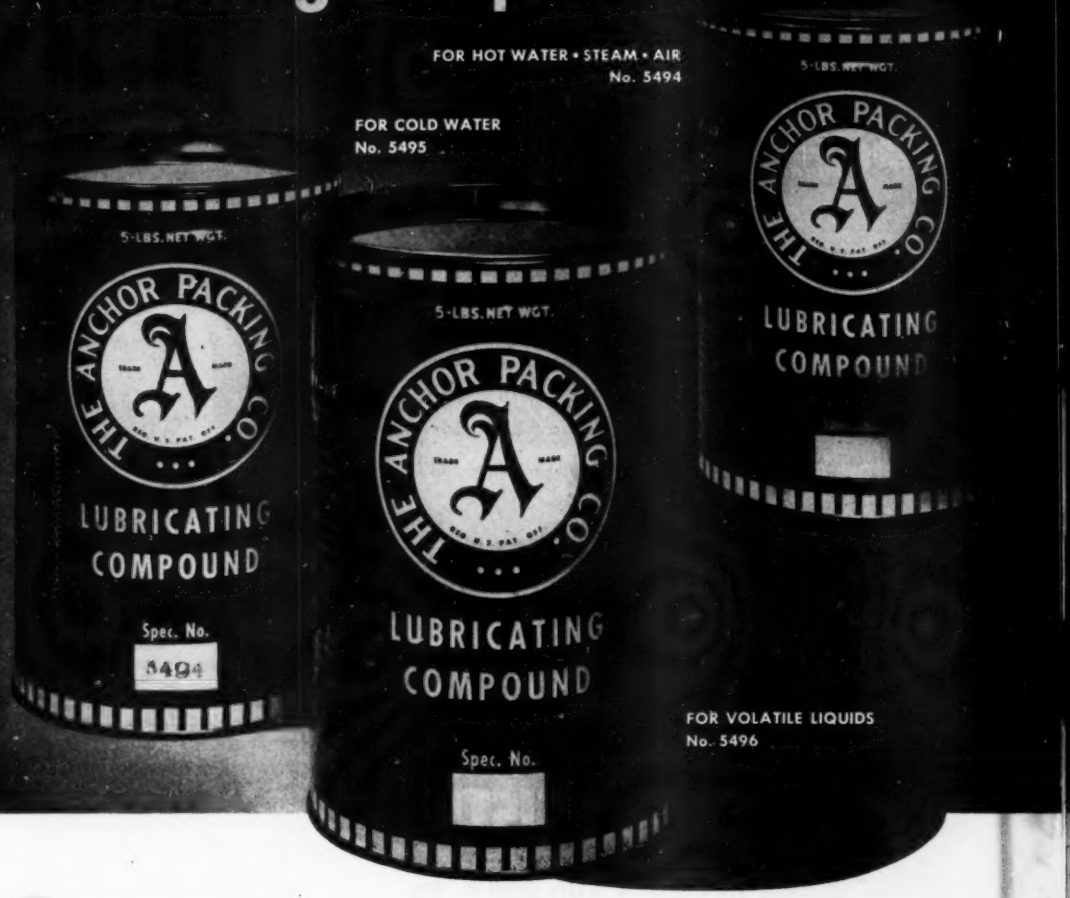
We will gladly have a Manzel lubricator engineer submit recommendations without obligation.

Just write...

Manzel

326 BABCOCK STREET
BUFFALO, NEW YORK

Lubricating Compound



The Anchor Packing Company offers you a real "saver" in lubricating compounds . . . three distinct specifications: No. 5494 for hot water, steam, air . . . No. 5495 for cold water . . . and No. 5496 for volatile liquids.

Remember—the proper lubricant will assist greatly to obtain long packing life and prevent wear of moving parts.

We invite your inquiry today.

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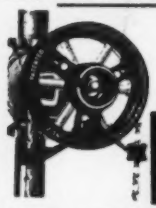
FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

NOW! All Overhead Valves are Instantly Accessible



with the LOW-COST

Babbitt
Adjustable
SPROCKET RIM
with Chain Guide

• Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

• Overhead valves — no matter how high up, or in whatever hard-to-get-at location — are instantly accessible from the floor! Operation of valves is quick, easy, positive and safe with the BABBITT Adjustable Sprocket Rim with Chain Guide. No more climbing on bench, machine, boiler or treacherous stepladder; no time-wasting.

• The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

• Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.

BABBITT STEAM SPECIALTY CO.
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IF you change your address,

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Also . . . . . .

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We need them *both* to make the change.

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DESIGNED AND BUILT TO MEET ALL REQUIREMENTS
for any Size Power Dam....

From the smallest hand operated, to the large motor operated, MURRAY Gate Hoists are designed and built in a wide range of capacities, from less than 1 ton to over 100 tons. During our over half century of designing and building gate hoists, we have developed many designs for the different types of gate hoist problems. Perhaps we have several designs and patterns that will fit your requirements. In planning gates or gate hoists, we suggest you communicate with us before your plans for the project as a whole, are complete . . . it will save expense and much preparation time. We also build gate hoists especially from your plans and specifications, if desired.

Our Engineering Department is at your service any time, to help you solve problems involving Power Dam Gates and Gate Hoists.

O. J. MURRAY MANUFACTURING CO. *WAUSAU, WIS.*
Manufacturers Since 1883

NOW CLEAN *GENERATORS MOTORS* Without Solvents

NO Drying Period Toxic Hazards

with New Pangborn AC-4 Blast Machine

NOW YOU CAN clean electric motors, generators and turbines *without solvents!* The new Pangborn AC-4 Blast Machine scours armatures, parts, frames, coils, etc. with soft (20-mesh) corncob grits.

Since no liquids are used there is no need for drying periods and toxic or explosive hazards are eliminated. Large equipment can be cleaned *in place* and no residue is left to create gum or to break down insulation.

Simple and Inexpensive

New Pangborn AC-4 Blast Machines operate from a standard 40-pound air supply. Material costs average 1/10 of other methods and complete cleaning is finished in half the time.

FOR DETAILS, write today outlining your operation. Address: PANGBORN CORPORATION, 90 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

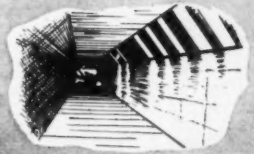
Pangborn
BLAST CLEANS CHEAPER with the right equipment for every job

WHERE TO USE LUMNITE IN POWER PLANTS

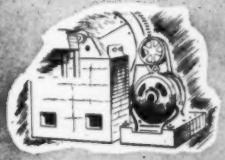
Steel Stack Linings

Ash Pit and Cinder Catcher Linings

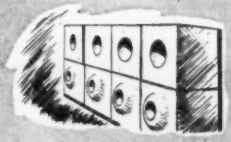
Coal Bunker Linings



Flue and Duct Linings



Overnight Structural Concrete



Castable Refractories

Factory-prepared mixtures of LUMNITE and selected aggregates. Mixed with water on the job, cast into place for door linings, arches, baffles, furnace walls. Special shapes can be cast in molds, ready within 24 hours. Castables to meet different temperature and insulation needs are made by manufacturers of Refractories, sold by their distributors.

FOR RAPID REPAIRS

SAVE TIME, CUT COSTS

with a CASTABLE REFRACTORY

Quickly adaptable to any size, shape or thickness, Castable Refractories made with Lumnite* are economical first aid for emergency repairs.

For baffles, furnace walls, arches, door linings, you get one-piece refractories that reduce heat loss, prevent infiltration of outside air. No shrinkage to bother about. High spalling resistance. Low upkeep.

They're easy to use, too. Add water to the packaged mixture, cast it in place or in a simple form or mold. Large jointless sections are as easy to cast as small special shapes. There's no cutting or fitting. And rapid hardening Lumnite Castables are ready for service in twenty-four hours or less.

You get time-saving, adaptable construction and long, durable service when you specify a Castable Refractory made with Lumnite. You get a balanced, tailor-made refractory that results from the blending of selected materials. You get suitable refractory aggregates with cold-setting, high-strength binder, Lumnite. Castables to meet different temperature and insulation needs are made by manufacturers of refractories and sold by their distributors. For further information, write to Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Ave., New York 17, N. Y.

**"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

P-L-18RR

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

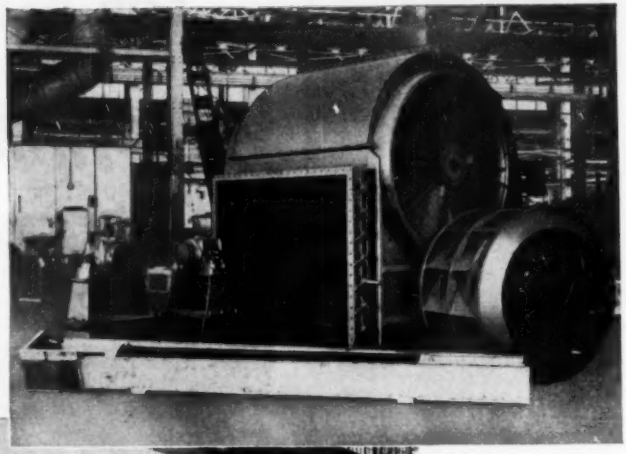
REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

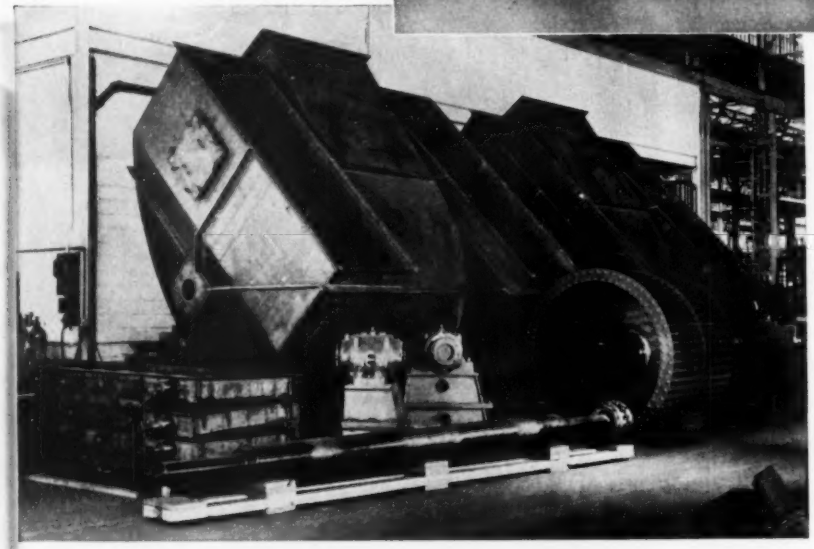
"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—NBC Network*

You'll improve over-all power plant efficiency with

AMERICAN BLOWER MECHANICAL DRAFT FANS

To keep progress with ever-increasing demands for electrical horsepower, America's great public utilities are constantly expanding their plants and facilities and extending the scope of their services.





Above is shown an American Blower Forced Draft Fan with component parts, prior to shipment to one of America's leading public utilities. This fan is rated at 180,000 CFM at 100° at 18.2" static pressure.

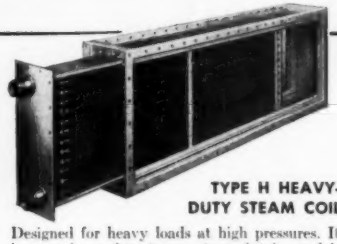
The photograph at left shows two American Blower Induced Draft Fans with component parts. Each has a capacity of 313,000 CFM at 420° at 10.1" static pressure. Sirocco Induced Draft Fans, with die-formed forward curved wheel blades are designed and proportioned specially for induced draft work and are now used on 1,000,000#/hr. steam boilers.

That a vast majority of these utilities depend on us for important equipment, is a tribute to the fine performance of American Blower Products as well as to the engineering skill available through our strategically located branch offices.

May we serve you?

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation



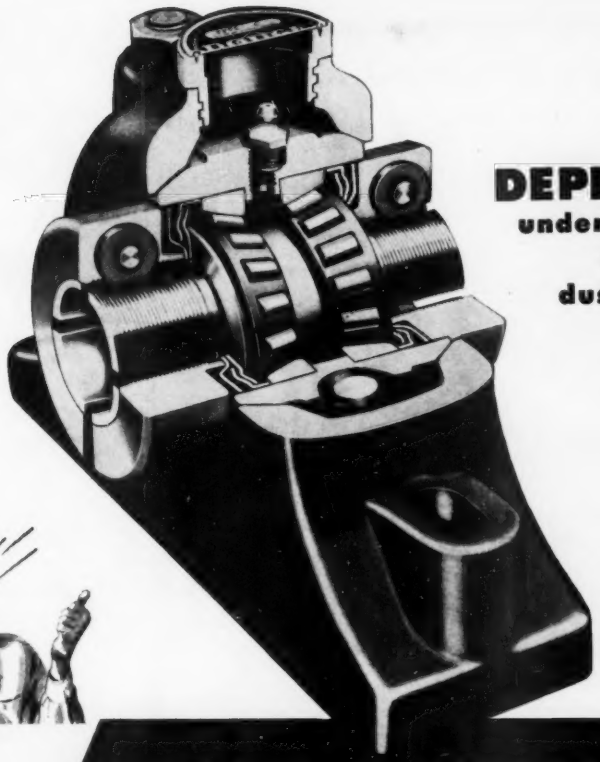
TYPE H HEAVY-DUTY STEAM COIL

Designed for heavy loads at high pressures. It is corrosion-resistant, easy to maintain, and is completely accessible.

YOUR BEST BUY AMERICAN BLOWER POWER PLANT EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON



DEPENDABLE
under severest conditions of dust and dirt!

DODGE-TIMKEN

- Even under layers of grime, dirt and abrasive dust encountered in many production operations, the Dodge-Timken Type C bearing carries its power load smoothly, efficiently, without interruption—because it's
- Triple-sealed to prevent the entry of dust, however fine. Accurately machined steel seals keep dirt *out* and lubricant *in*.
- Dodge mounts, seals, houses Timken precision bearing units in rugged assemblies (four different types) to deliver a minimum of 30,000 hours uninterrupted service.
- Dodge Timken Type C Pillow Blocks are fully self-aligning, with both radial and thrust carrying capacity.
- Delivered fully assembled, adjusted and lubricated, ready to lock on shaft. Locking collars at both ends insure firm fastening.
- Normally available from Dodge Distributors' stocks, sizes from 1-7/16" to 4-15/16".

DODGE MANUFACTURING CORPORATION, 3200 Union Street, Mishawaka, Indiana

DODGE

of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor for assistance on new, cost-saving methods. Look for his name under "Power Transmission Equipment" in classified phone book.

FIRST IN POWER TRANSMISSION MACHINERY!

V-BELTS AND TAPER-LOCK SHEAVES

TORQUE-ARM SPEED REDUCERS

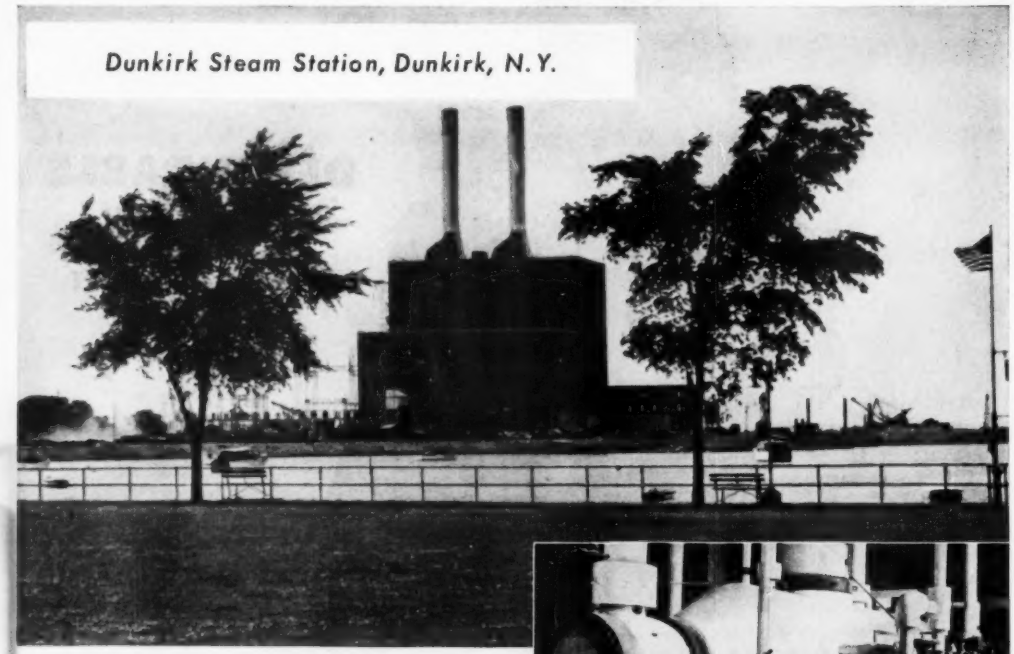
ROLLING GRIP AND DIAMOND D CLUTCHES

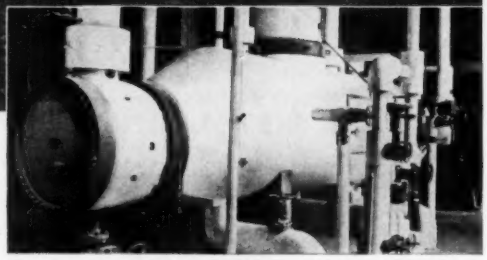
SOLID STEEL CONVEYOR PULLEYS

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

Dunkirk Steam Station, Dunkirk, N.Y.





ALCO *Evaporator on the job at Dunkirk. Extracted steam is delivered to the tubes at 72 psia and 285° superheat to produce 16,400 pounds per hour of net vapor.*

How Alco Evaporators give this station High purity make-up water

Typical of the effective engineering which keynotes the design of this 160,000 kw plant of the Niagara Mohawk Power Corporation, are the two ALCO evaporators, each of which furnishes 20,000 pounds per hour of high purity make-up water for the two 80,000 kw generating units.

These single-effect evaporators are of the ALCO patented "Flextube" thermal descaling type. Each evaporator contains 586 square feet of effective heating surface comprising 80-20 Cupro-nickel tubing, and uses a centrifugal type vapor purifier. Maximum working pressure for the shell side is 100 psig; for the tube side, 150 psig.

Other ALCO equipment in this new station includes high pressure extraction feedwater heaters, drain coolers, and evaporator condensers—all playing an important part in maintaining peak efficiency in this reheat cycle plant.

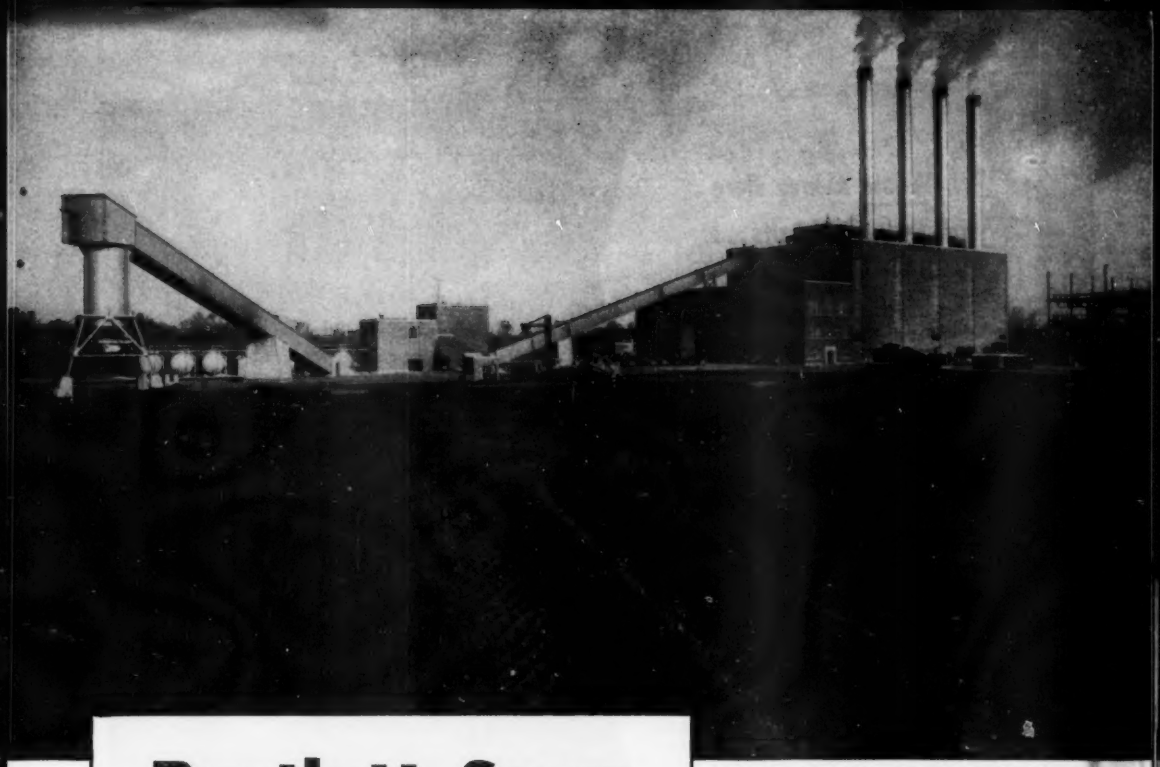
Check these other ALCO *Evaporator design features:* ample vapor disengaging space . . . separate, removable channel and cover . . . patented ALCO compression bolting. All add to the effectiveness of the evaporator. Write now for more details, or call the nearest ALCO Sales Engineer at Chicago, Houston, Kansas City, Los Angeles, New York or Tulsa. Plants: Dunkirk, N. Y. and Beaumont, Texas.

ALCO

ALCO Products Division

AMERICAN LOCOMOTIVE COMPANY

***In step with tomorrow*—ALCO AIRCOOLERS, Heat Exchangers, Evaporators, Feedwater Heaters, Pressure Vessels, Pipe**



General View of Meredosia Power Station
Central Illinois Public Service Co.
Sargent and Lundy
Consulting Engineers

Bartlett-Snow coal handling at Meredosia

● The illustration above shows the first 100,000 KW unit of a plant which is to be extended into a 200,000 KW station. All coal handling equipment including the receiving and reclaiming hoppers and grillage, duplex feeder, conveyors, galleries, breaker screen and all supporting structures were fabricated in our shops, and installed by us, to Sargent and Lundy's specifications. For maximum efficiency and fixed unit responsibility, let the Bartlett-Snow coal handling engineers, with their long experience and complete facilities, work with you on your next job.

DESIGNERS
ENGINEERS

BARTLETT-SNOW
CLEVELAND 5, OHIO

FABRICATORS
ERECTORS

Belt Conveyor in Tunnel
Handling Coal from Track Hopper

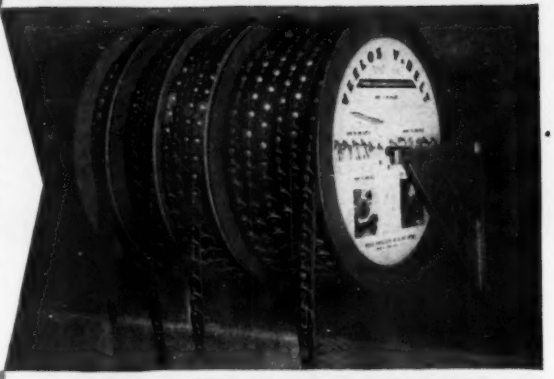
Drive for Collector Belt Under Breaker
the Refuse Belt and Automatic Sampler

You Waste Money Here with Endless V-Belts...

because it takes *extra* dollars to keep a complete stock of different sizes of endless v-belts . . . *extra* dollars to provide adequate storage space . . . *extra* dollars to maintain an accurate inventory control . . . and *extra* dollars in an inventory of belts that may deteriorate before they can be put into service.

but You Save Money Here with Veelos V-Belt...

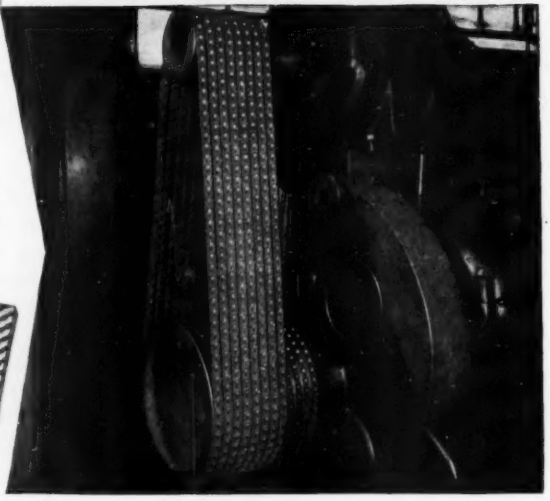
because these 4 reels of Veelos *adjustable* v-belt in the O, A, B and C widths will replace up to 316 sizes of endless v-belts. Veelos on reels is easy to store on the wall or floor . . . easy to control, for a glance tells you stock on hand. And Veelos holds inventory investment dollars to a minimum while providing *the right size v-belt when you need it*—without delay, without deterioration.



and You Make Money Here on Continuous Production...

because Veelos *keeps* your machines producing. Profit-killing downtime for belt installation is practically eliminated. Veelos installs quickly —on some drives in less than one-tenth the time of endless v-belts because it is unnecessary to dismantle outboard bearings. Simple adjustment permits easy maintenance of uniform tension on all belts . . . assures constant, vibrationless, full power delivery.

For the complete story on Veelos, the adjustable v-belt, write for your copy of the VEELOS DATA BOOK.



VEELOS
THE LINK
V-BELT

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

Made in all widths in three types: regular, oil-proof, static conducting. Also double V in A and B. Package on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. VEELOS is known as VEELINK outside the United States.

MANHEIM MANUFACTURING & BELTING COMPANY, MANHEIM, PA.

IF YOUR STEAM NEED IS 50,000 lbs./hr. OR MORE

Write FOR THIS 40 PAGE CATALOG!

To meet the needs of those who require equipment to generate steam in large quantities, we have prepared a special book. In 40 pertinent information-packed pages on power plant equipment, we have described and illustrated design details and construction features of Erie City Boilers, Water Walls, Superheaters, Air Preheaters and Economizers. Users of large quantities of steam can find at a glance just what they need for new power plants, expansion programs and rehabilitation of existing facilities. The busy engineer or other executive interested in large capacity steam generating equipment will receive a prompt reply to his request for publication SB-30.

COMPLETE STEAM POWER PLANT EQUIPMENT

ERIE CITY

Complete Steam Generators • Type C 3-Drum Boilers • Types VL & VC 2-Drum Boilers • "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • "Keystone" Packaged Steam Generators • Coal Pulverizers • Underfeed and Spreader Stokers • Welded Pressure Vessels for the Process Industries.

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CONCENTROL STOPS FOAMING

BEFORE

Laboratory demonstration shows foaming of highly alkaline solution in test cylinder.

This laboratory demonstration shows — as do scores of successful installations — that Bird-Archer's Concentrol is a highly effective anti-foam agent. It quickly stabilizes alkaline boiler water . . . eliminates foaming action and carryover. With Concentrol, you can forget about bouncing water gages. You get good quality dry steam every hour of every day.

Concentrol is available in liquid, powdered or briquette forms. Special Concentrol formulations are also available containing other commonly used boiler water treatment chemicals such as tannins, phosphates, alkalies, sulfite, etc.

See for yourself how economical Concentrol helps improve steam quality. Your Bird-Archer representative will demonstrate Concentrol in your plant . . . make specific recommendations for its use. Consult him, or write direct to Bird-Archer, outlining the details of your boiler operation.

FREE DATA SHEET AVAILABLE

HOW CONCENTROL WORKS

Concentrol works by effecting a rapid change in surface tension of steam bubbles which permit coalescence of small steam bubbles into bubbles of larger sizes. This results in the formation of unstable bubble films which break readily upon reaching the steam disengaging surface of the boiler water. This does away with foam build-up and subsequent carryover.

BIRD · ARCHER

WATER TREATMENT

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503 McGill Building, Montreal, Canada

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BA 102

AFTER

Same solution after addition of 12 ppm of Concentrol Anti-foam. Constant heat conditions were maintained during test.

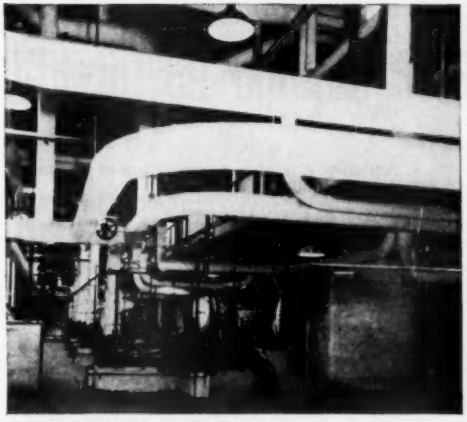
1250 psi-950° F harnessed by BLAW-KNOX POWER PIPING

THE FIRST and second units of a contemplated 400,000 KW high pressure steam turbo-electric station, designed by Southern Services, Inc., are now in operation at Plant Yates on the lines of the Georgia Power Company.

Hidden in the vitals of this huge plant is a series of ten-inch alloy steel lines carrying steam to the turbines at 1250 psi and 950° F.

This is no ordinary pressure though the number of these high pressure plants is increasing. Such piping requires extraordinary skill and large scale equipment for its fabrication and installation.

Blaw-Knox Power Piping Division is thoroughly experienced and adequately equipped for fabricating and installing high pressure piping.



POWER PIPING DIVISION bends, welds, tests and installs various alloy piping materials according to your specifications for low or high pressures, extreme temperatures, and to meet special corrosive conditions. X-Ray, Gamma-Ray, Magnaflux, and ZY-glo equipment available in our plant.

Send for a copy of Catalog No. 51 which describes the complete line of Blaw-Knox Adjustable Pipe Hangers, Vibration Eliminators and Supports.

POWER PIPING DIVISION

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Pump shafts get a beating under conditions like these

That's why Ingersoll-Rand uses "K" Monel

BOILER FEED PUMPS
AT THE PHILIP SPORN PLANT
(American Gas and Electric System)

Dynamic Head	**6,000 ft., 2,400 psi**
Gals. per minute	**1,100**
Service	**Continuous, pumping deaerated distilled water**
Length of Shaft	**99½" to bearings**

Boiler units of the Philip Sporn Plant are served by Ingersoll-Rand "double case" pumps.

Their shafts are made of "K"® Monel.

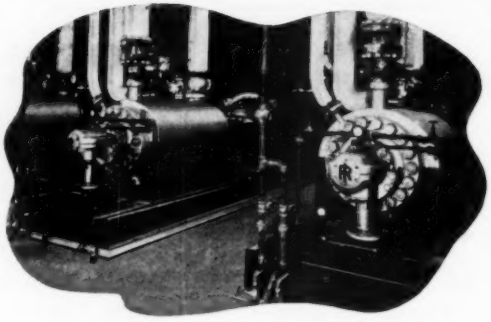
Of course, "K" Monel is ***strong***. But that isn't the only reason I-R used it. Nor is it because "K" Monel is ***corrosion-resistant.*** Or because it has unusually high ***resistance to corrosion-erosion and galling.***

What is the reason then?

Actually, a unique combination of *all* these properties. A combination that provides you with long-life dependable pumps for the most severe operating conditions.

"K" Monel's machinability offers other advantages, too. That's because it can be machined in its as-forged condition... and then heat-treated for extra hardness without danger of excessive warpage. After this, "K" Monel requires only finish grinding.

If you are concerned with pump purchasing or maintenance, it will pay you to keep "K" Monel in mind, even though defense demands for "K" Monel are critical.



Each pump at the Philip Sporn Plant is driven by a 2000 hp, 3570 rpm, 2300v induction motor.

Write for your copy of this valuable bulletin

Technical bulletin, T-9, "The Engineering Properties of 'K' Monel," is yours for the asking. It contains data on the composition, mechanical properties and physical constants of heat-treatable, non-magnetic "K" Monel; working properties, corrosion resistance, instructions for heat treatment to obtain high strength and hardness.

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Nickel Alloys

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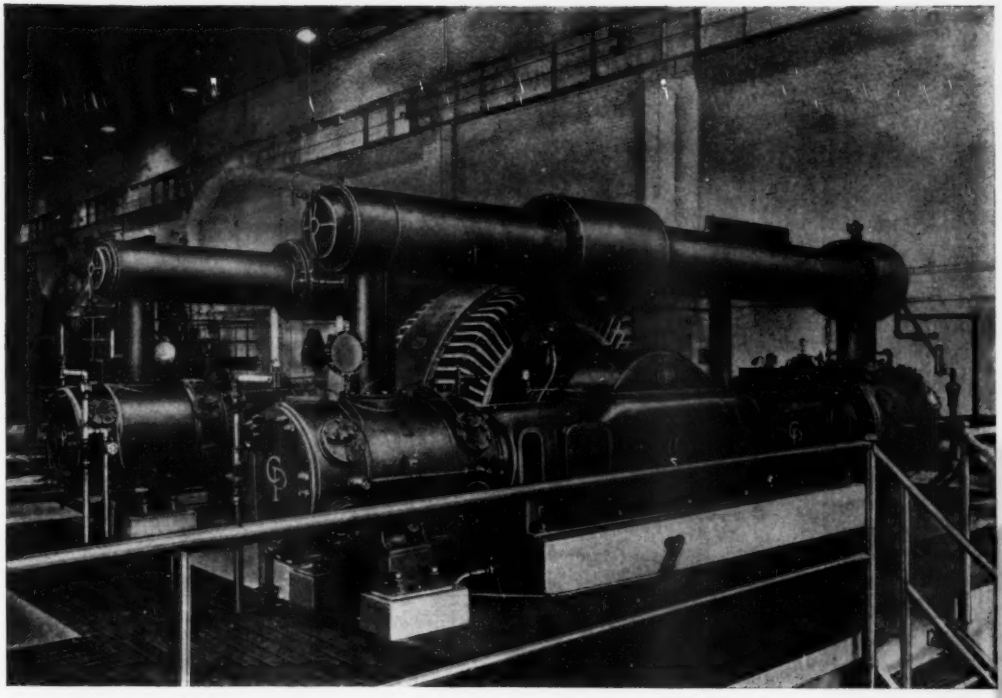
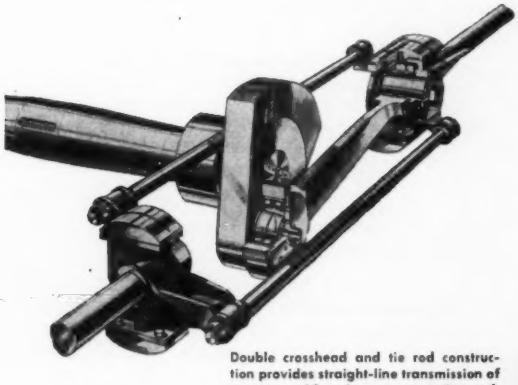


CP FOUR-CORNER motor-driven compressors

6,000 to 12,000 cfm piston displacement at 100 lbs. pressure



Double crosshead and tie rod construction provides straight-line transmission of power — with only one connecting rod. Roller bearings and crank discs are mounted by the oil injection method.

Class H-CE Duplex Synchronous Motor-Driven Compressors have anti-friction roller bearings throughout: spherical roller main and crankpin bearings . . . heavy-duty needle bearings at crosshead pins.

The use of roller bearings in the running gear, and the oil injection system of bearing installation and removal, eliminate all danger of misadjustment in maintenance, and permits the use of one-piece crank disc and solid-end connecting rods — the strongest and safest type.

Write for Bulletin 726-C

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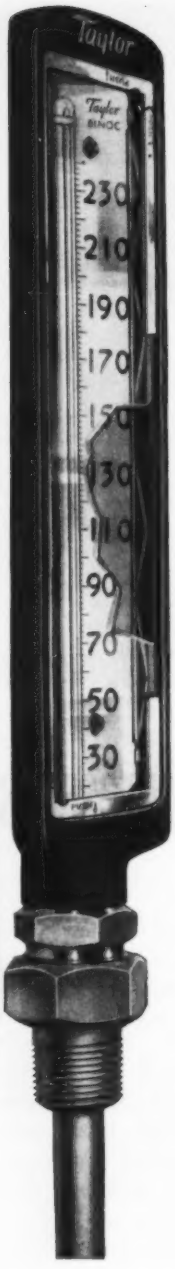

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YES, COMPARE—and we believe you'll choose Taylor—the Industrial Thermometer that will give you all the easy-to-read accuracy and life-long performance that you pay for! Compare these Taylor features with any other mercury-in-glass industrial thermometer:

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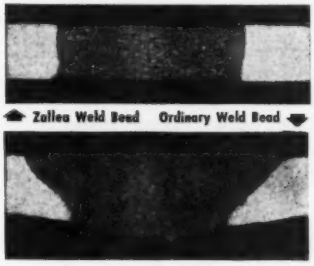
Zallea Expansion Joint News

PUBLISHED BY ZALLEA BROTHERS—WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS

Expansion Joint of the Month

ZALLEA CONTROLLED WELDING

For longest service life, it is essential that the corrugated bellows have a uniform thickness throughout. Only in Zallea Stainless Steel Flexible Connectors are you assured of this optimum condition because Zallea alone produces a longitudinal weld of the same thickness as the parent metal. Zallea metallurgists, after



analyzing the many known welding processes, adopted an exclusive variation of the Heliarc process and added a grain refining procedure to the finished weld. In hundreds of brutal flexing tests, not one failure occurred within 30 degrees of the weld line! More important was the fact that these bellows lasted 4 to 8 times longer than bellows having a shielded arc welding bead. Note the exclusive Zallea controlled welding technique as compared to the welding procedure used in other flexible connectors. When you want the best in flexible connectors, always specify Zallea...you'll find it pays!

. . . a brand new 4-page folder on *all* Zallea Expansion Joints. Send for your copy of Bulletin 351 today!

ZALLEA BROTHERS, 814 Locust Street, Wilmington 99, Delaware.

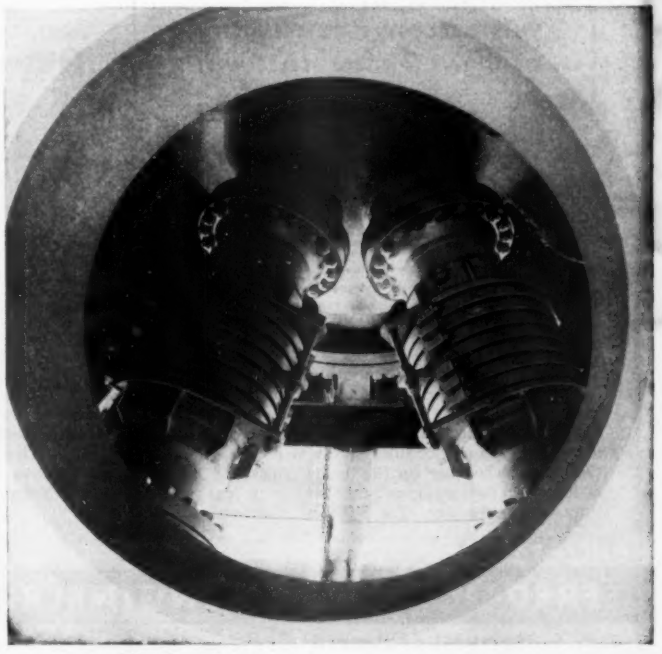
Large Refinery Selects Zallea

Big refinery operation requires only the best equipment . . . for assurance of dependable, long-lasting service. That's why Zallea Stainless Steel Expansion Joints were the logical choice for installation in the Houdry Process Cat Cracker at California Refining Company, Perth Amboy, N. J.

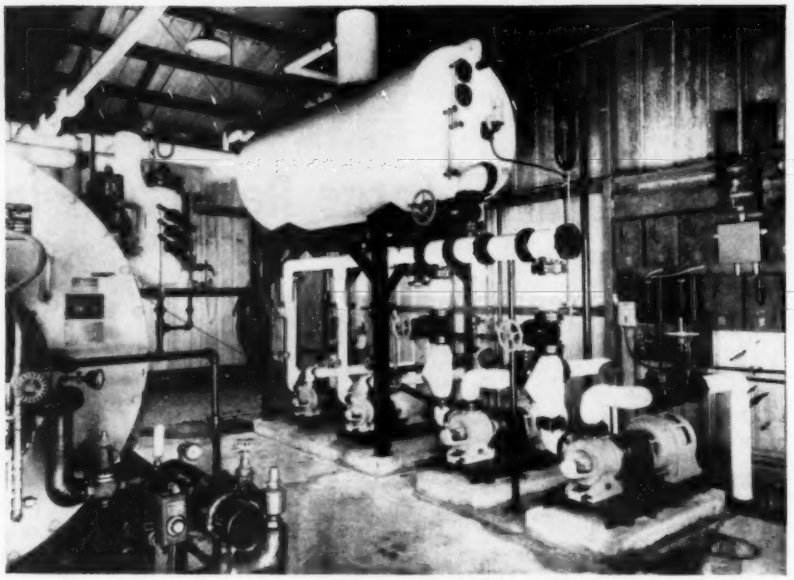
A total of 68 Zallea Joints are in service at this East Coast refinery, ranging in size from 30″ diameter downward, and from 11¾″ axial movement in combination with 4″ lateral movement any side of center line, down to lesser movements.

Shown below are two of the 68 Zallea Joints. These are 16″ diameter, modified Universal self-equalizing units, made of stainless steel and designed for an axial movement of 3⅞″ and a lateral movement of ¾″, either side of center line. These joints are installed on a line carrying hot bead catalyst to the engager, and operate at 20 psi at a temperature of 900° F.

Zallea Stainless Steel Expansion Joints are the first choice of refineries for dependable service. It's the high quality built into every Zallea Expansion Joint that makes them long-lasting—even under the severest service. Remember, there's no packing to deteriorate . . . no maintenance required. Just install them and forget them. There's a Zallea Expansion Joint for almost every requirement. Available in diameters from 3 inches to 30 feet for temperatures from sub-zero to 1600° F. . . . for pressures from vacuum to 300 psi in standard designs and up to 2000 psi in special designs.



(Advertisement)

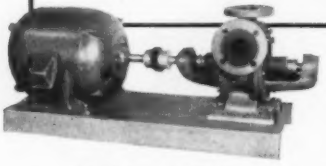


Schaub Duplex Deaerator System, installed in a new Pacific Northwest plant, handling one 100 H. P. and one 500 H. P. packaged boilers, 150 lbs. working pressure.

You Get **MORE** in a **SCHAUB**

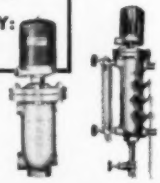
BOILER RETURN SYSTEM

THIS EXCLUSIVE COMBINATION OF *"Plus Values"* TELLS WHY:



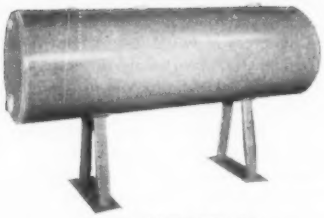
Schaub Master-Bilt Turbine Pump

Patented fleximatic shaft seals and prelubricated ball bearings mean no packing and no greasing — *ever!* When you install a Schaub Master-Bilt Pump you can forget about it.



Ultra-Dependable MAGNETROL Boiler Water Level Control

Combination pump control and low water safety cut-off. Friction-free Magnetrol assures boiler safety. No bellows to stiffen, no packing in head, no tricky electrode circuits to fail. All models approved by Underwriters' Laboratories, Inc.



Chromosoid-Lined Receiver

10-year guarantee against corrosion. Schaub engineers developed Chromosoid lining by working with leading chemical researchers. You're protected against costly and premature replacements. No more rust-clogged systems.

Each of these, along with other features, combine to produce the high overall efficiency, economy and long-lasting service characteristic of every Schaub System. Operators who buy on the basis of facts and performance find that they get more out of a Schaub System because a Schaub System has *more to give them.* When a Schaub System is compared with any other, the *least* difference is the difference in price! That's just another way of saying *you pay less per year for a Schaub System.*

Know the Facts! Schaub also builds Patented Heat Reclaim and Spray-Type Deaerating Systems for exacting requirements from 10 to 1000 boiler horse power. Write for new Schaub Catalog No. 55 which gives more information on all types of Schaub Systems.

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These Points are Basic Factors:

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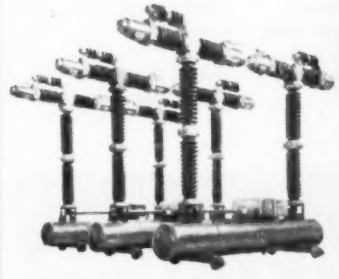
OUTDOOR BREAKERS — 69 TO 230 kV



OUTDOOR CUBICLES — 14.4 TO 46 kV

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Please send me specifications and details on your
☐ indoor ☐ outdoor air blast breakers for
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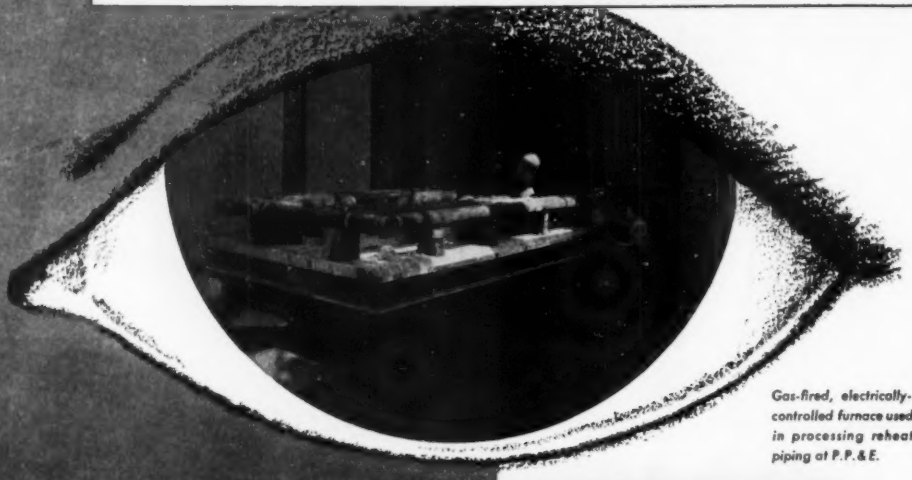
Looking at REHEAT



Gas-fired, electrically-controlled furnace used in processing reheat piping at P.P.&E.

Through Experienced Eyes

Proper piping is essential in order to realize the benefits inherent in reheating steam to higher temperatures—increased volume per pound of water evaporated . . . reduced condensation in lines, casings, cylinders, etc. . . . improved BTU output . . . better fuel economy.

Remember when 750° F. was thought to be a high reheat temperature? Even then P.P.&E. was ahead of the needs in piping that would carry the load. As the trend toward higher temperatures continued, P.P.&E.'s experience accumulated.

That's why the conditions encountered in present-day reheat temperatures over 1000° F. are thoroughly understood by P. P. & E. engineers—and why adequate materials, design know-how, methods of treating and fabricating, and testing procedures are available.

Look to Pittsburgh Piping and Equipment Company for the experience, and the leadership in methods that assure greatest safety, highest efficiency, and longest service from high temperature, high pressure piping.

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Compiled from some 450 major references, this handbook covers many new advances such as: latest information on synthetic fuels; the heat pump; gas turbines; spreader stokers; latest research in combustion and furnace and equipment design; package boilers, etc. The smoke and fine particles section is unusually complete, and in view of current interest in air pollution, very timely. The book contains a wealth of information for the experienced engineer, yet gives instructions for firing and operating equipment that the boiler room operator will understand. Comparative tables are included to show advantages and disadvantages, salient features, applications, performance, and characteristics of optional equipment or methods

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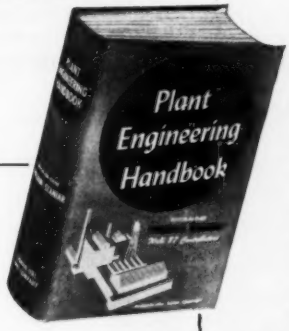
Here are quick answers to your most troublesome questions . . . over 2,200 pages of data in every branch of mechanical engineering—from aeronautics to mechanical refrigeration, from power generation to welding, from metal-cutting machines to hoisting and conveying. This handbook covers theory, standards, and practice, and has been compiled by over 100 experts, each a specialist in his field. Among the new or greatly modified items included in this 5th Edition are: fluid mechanics, aircraft jet propulsion, television, solar heating, modern casting methods, industrial supersonics, plastics, elastomers, rocket fuels, gas turbines, atomic power, *and many more.*



3 PLANT ENGINEERING HANDBOOK

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Prepared by more than 80 specialists

1955 pages, 6 x 9, 1406 illustrations, 544 tables, $15.00

Now you can find in a single handbook the facts that literally do show how to run a plant today—any industrial plant—efficiently and economically.

Representative of many years' work in the field, this guidebook provides not only an unequalled amount of reference material, but also basic treatises that will help you develop a broad background. It answers questions in the economic, mechanical, chemical, and power operation of a plant . . . gives essentials of today's good practice in 76 major areas of plant operation and maintenance—principles and methods followed by leading manufacturing enterprises—and a really amazing compilation of data, tables, formulas, graphs, and abbreviated information for constant consultation.

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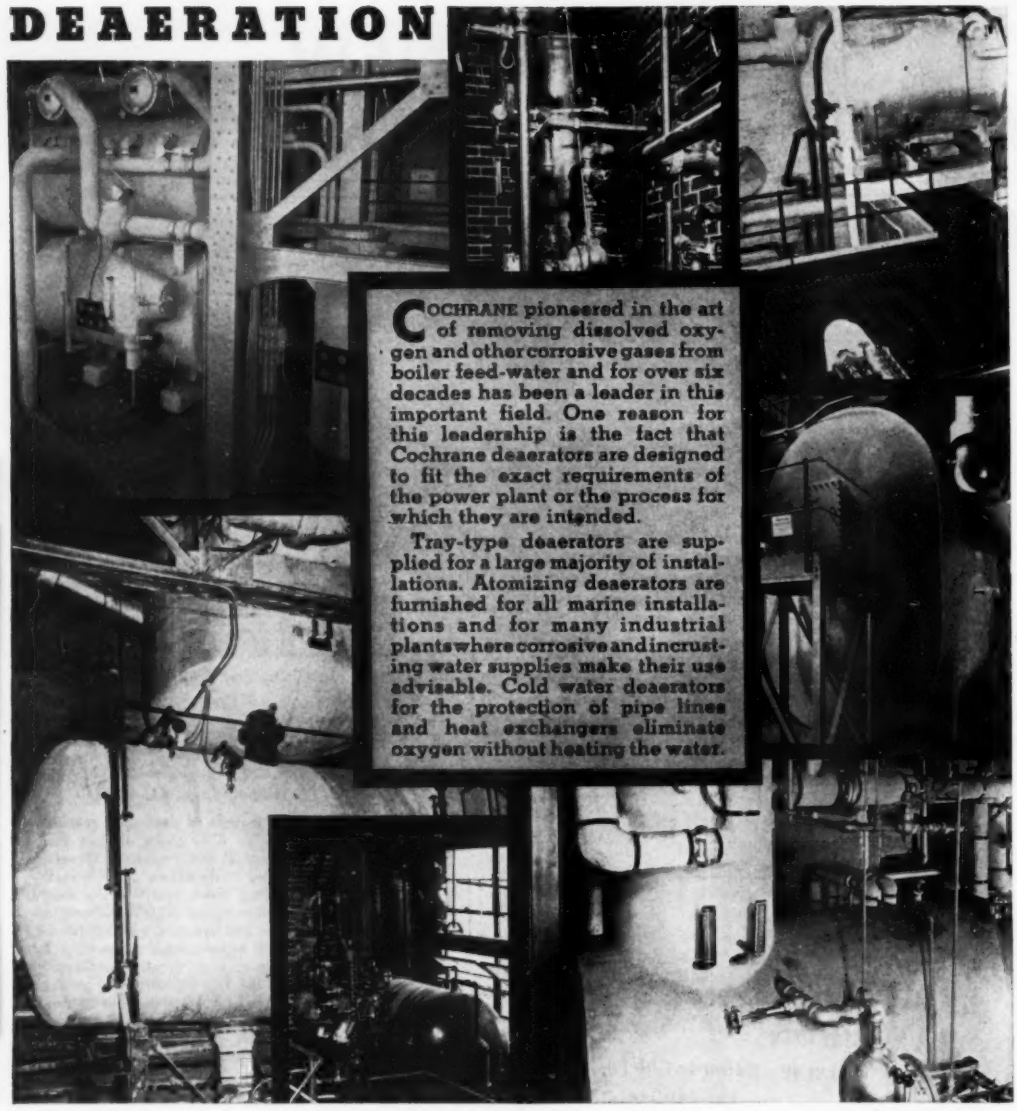
DEAERATION



COCHRANE pioneered in the art of removing dissolved oxygen and other corrosive gases from boiler feed-water and for over six decades has been a leader in this important field. One reason for this leadership is the fact that Cochrane deaerators are designed to fit the exact requirements of the power plant or the process for which they are intended.

Tray-type deaerators are supplied for a large majority of installations. Atomizing deaerators are furnished for all marine installations and for many industrial plants where corrosive and incrusting water supplies make their use advisable. Cold water deaerators for the protection of pipe lines and heat exchangers eliminate oxygen without heating the water.

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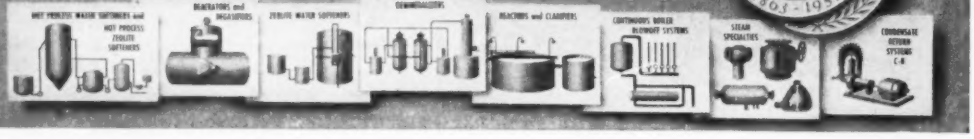

JUST "*dial in*" YOUR WEATHER!

Above you see the control panel of a "weather factory" for plant research at California Institute of Technology. The weather making is part of the important work being done in Caltech's half-million dollar Earhart Plant Research Laboratory—an imposing layout embracing six air conditioned greenhouses and thirteen air conditioned laboratories, all dedicated to uncovering more basic knowledge of plants and their cultivation.

The plant experiments are being made under the most closely controlled conditions of weather, light, temperature and sterility existing anywhere in the world today. To accomplish this control, the greenhouses are provided with the specially built Minneapolis-Honeywell control panel equipped with Marsh Pressure Gauges, and a time clock panel, constructed by Caltech scientists, for controlling lights. Temperature can be held to a fraction of a degree in any part of the greenhouses and laboratories.

Caltech scientists hope that some of their fundamental research will eventually indicate the best growing conditions for varieties of vegetables increasing the world's food productivity, and may yield vegetables of greatly increased nutritional value.

Here is a project where accuracy of control and operation outweighs all other considerations. So it is particularly significant that all of the pressure gauges on the panel above are Marsh Gauges. A distinguished instrument, Marsh keeps distinguished company. For all plant services and equipment requiring pressure gauges, insist on Marsh.

Marsh alone has the RECALIBRATOR—quickest and best way to correct a gauge or dial thermometer that has been knocked out of adjustment.

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MARSH GAUGES

THE STANDARD OF ACCURACY

THIS PIPING MUST NOT BE SPRUNG—OR IT WILL BIND THE PUMP!
I'M MAKING SURE. THE PIPING FITS THE UNION—I'LL PUT THIS SUPPORT UNDER THE PIPE TOO!

How to Get the Most Work Out of Your VIKING PUMPS

In making suction and discharge pipe connections on a Viking Rotary Pump be sure that no strain is imposed on the pump casing by the pipe. Properly installed, the shaft of a Viking pump should turn easily by hand. If this is not possible you have either sprung the pump in making the pipe connections or with the foundation bolts.

For valuable help in installing, operating and maintaining your pumps, write today for your FREE copy of the Viking Service Manual W. It's a handy, illustrated booklet filled with practical information. Get EXTRA wear out of your pumps by giving them EXTRA care. The Viking Service Manual W tells you how.

VIKING
AN HONORED NAME IN PUMPING

See Our Catalog in SWEETS

Viking PUMP COMPANY
Cedar Falls, Iowa

CONTINUOUS BLOW-OFF
needs NO maintenance
with the ROTARY DISC
UNIBLOW VALVE

Complete blow-off unit includes sedimentation chamber, clean out valve, by-pass line and Uniblow Rotary Disc Valve.

Stainless steel rotary disc valve offers 15 calibrated orifices to provide any rate of flow. Sediment chamber protects orifices from plugging. No moving parts to wear out or leak.

Read how to cure blow-off problems and save on fuel!
Write for bulletin Today!

THE **UNIBLOW** VALVE COMPANY
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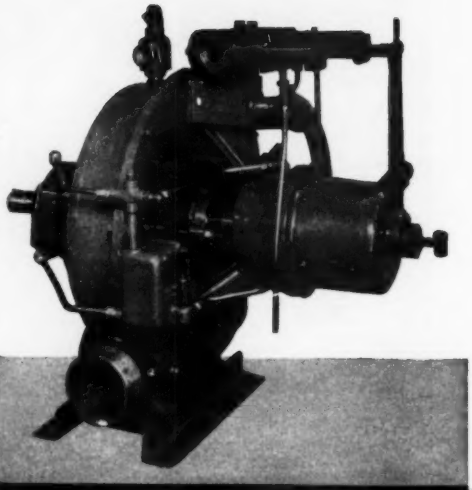

Wing
AUXILIARY
TURBINES

WING TURBINES are especially economical for driving pumps, fans, compressors, etc., in plants using steam in process operations. The turbines act as reducing valves on boiler steam pressure, the power which drives the turbines, therefore, being practically free.

Wing Turbines for over half-a-century have been noted for their rugged construction, trouble-free operation and long life.

Maximum BHp 150. Maximum Steam Temperature 750 F. Maximum Pressure 600 lbs. Back Pressure to 50 lbs. Speeds to 4000 rpm.

L. J. Wing Mfg. Co.
Linden, N. J.
Offices in principal cities

Nipple that failed after one year in main condensate line.
Corrosion of threaded area caused leakage in return line.
these parts were destroyed by RLC
Carbonic acid corrosion eats right through cast iron elbow.
Nipple shows characteristic pitting due to dissolved oxygen.

prevent Return Line Corrosion with Dearborn Formula 700 or 702

These destroyed parts were the victims of *return line corrosion.* If your maintenance costs are high because leaking or clogged return lines require replacement—if rusty condensate is coming back to your boilers—then it will pay you to use Dearborn Formula 700 or 702.

Return line corrosion is caused by oxygen and carbon dioxide. It can be effectively controlled thru the easy, inexpensive application of either the neutralizing amine-type treatment (Formula 700) or Dearborn's new filming-type amine treatment (Formula 702).

Your Dearborn Engineer is prepared to make specific recommendations on the use of Dearborn Formula 700 or 702 in your plant.

DEARBORN CHEMICAL COMPANY
Merchandise Mart Plaza • Chicago 54, Illinois

WRITE FOR THIS BULLETIN

Write for Bulletin 5013 which outlines causes of return line corrosion and describes how it can be controlled by Dearborn Formula 700 or 702.

DEPT. PO
Dearborn Chemical Company
Merchandise Mart Plaza, Chicago 54, Ill.
( ) Send a copy of Bulletin 5013
( ) Have a Dearborn Engineer call

Name.....
Position.....
Company.....
Address.....
City.....Zone....State.....

Dearborn
TRADE MARK REGISTERED
THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

"GUNITING" with *Super* ADACHROME-CAST

..SAVES OUTAGE TIME and MONEY

Use SUPER ADACHROME-CAST to gunite your stud tube water walls,—Fine-grained to penetrate the small apertures between studs,—packs to a dense mass when shot. One user reports SUPER ADACHROME-CAST lasted twice as long and took but one-third the time to apply as compared with a plastic chrome ore installation.

Excellent for coating brickwork when free of slag.

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Yours, *FREE* for the asking . . . an illustrated, detailed Bulletin on Super ADACHROME-CAST.

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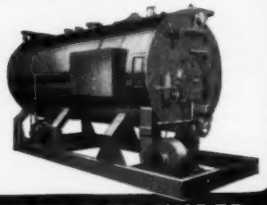
AUTOMATIC STEAM GENERATION

AMESTEAM GENERATOR

. . . a Compact, Self-Contained Unit



- FULLY PIPED AND WIRED
- FACTORY TESTED
- 80% EFFICIENCY

Oil, Gas or Oil-Gas Combinations
10 to 500 h. p. 15 to 200 lbs.

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BOX 2710, OSWEGO, N. Y.

Builders of Better Boilers since 1848
Manufactured under License in Canada by VOLCANO, Ltd., Montreal, P. Q.

ROM COAL reduced for pulverizer feed

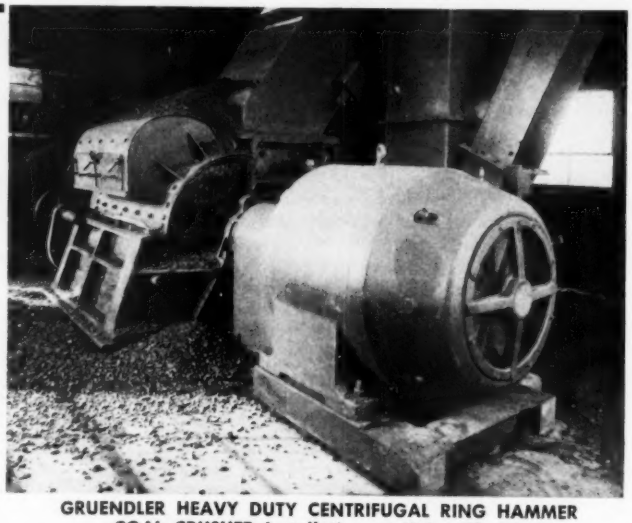
in New

UNION ELECTRIC COMPANY PLANT

Venice, Ill.

Plant constructed by the Stone & Webster Engineering Corp. Engineers and Constructors

Installed rating 300 T.P.H. through 1¼" — Handles up to 420 tons per hour.



GRUENDLER HEAVY DUTY CENTRIFUGAL RING HAMMER COAL CRUSHER installation at Union Electric

BULLETIN NO. 500 ON REQUEST

GRUENDLER CRUSHER & PULVERIZER CO.

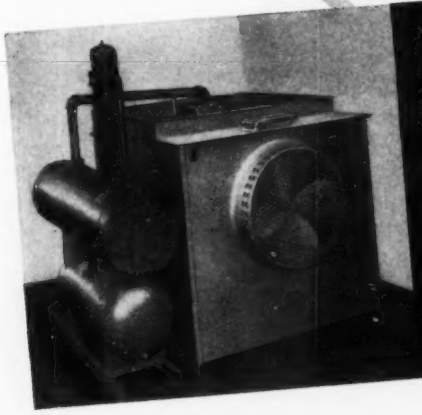
2915 NORTH MARKET ST. ST. LOUIS 6, MO.

DEAL WITH A LONG ESTABLISHED FIRM FOR CONSISTENT SERVICE AND PARTS • *SINCE 1885*

New

SAVES WATER and CUTS MAINTENANCE COSTS . . .

Illustrations show two views of a 35 ton Condenser Tower prior to partial disassembly for shipment.



Vogt

CONDENSER TOWER

FOR CONDENSING REFRIGERANTS

SINGLE RESPONSIBILITY:

Vogt, leading builder of refrigeration condensers, assumes responsibility for engineering the unit. Only one purchase order needed.

SHOP FITTED:

To cut down field assembly labor. Requires no cutting or fitting of pipe.

Designed for today's water conservation requirements, and to keep refrigeration costs low, the *new* Vogt Condenser Tower meets the need for a proven, readily cleanable condensing unit.

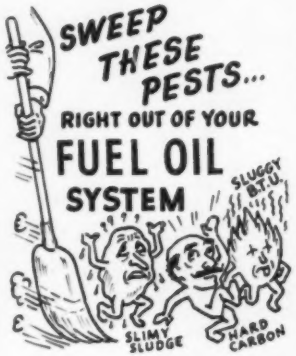
The Vogt Condenser Tower consists of a multipass straight tube condenser, a receiver, an oil trap, a cooling tower, and a water pump. Removable cast iron heads permit easy cleaning of the condenser tubes.

Water costs are extremely low since the cooling water is recirculated continuously and requires only a small amount of makeup to replace losses due to windage and evaporation.

Condenser Tower units are available in capacities ranging from 5 to 50 tons refrigeration. Additional information will be furnished upon request.

HENRY VOGT MACHINE CO., Louisville 10, Kentucky

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS, CHARLESTON, W. VA.



By Using DACAROL

The Ideal Fuel Oil Treatment

Why be bothered with sludge, moisture carbon, soot, incomplete combustion, clogged burners, etc. in your system! A few quarts of DACAROL per 1000 gal. of fuel will sweep all these trouble makers out.

More and more plants are using DACAROL every month due to value obtained. There is no substitute for DACAROL. This product is nationally known and has already proven its value in thousands of plants. Give YOUR SYSTEM A CLEANING WITH "DACAROL" AND USE "DACAROL" REGULARLY. You will be amazed at the savings obtained. USE DACAROL NOW.

Full details on DACAROL will be sent on request. DACAROL is a product developed through years of laboratory and plant use.

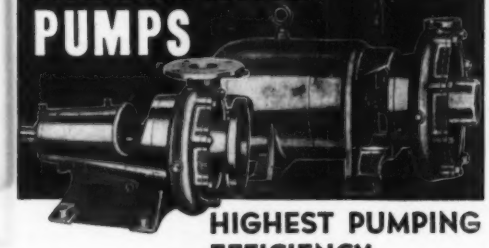
DACAR CHEMICAL PRODUCTS COMPANY

E. Liverpool, Ohio Plants Pittsburgh 20, Pa.

Registered Professional Engineers

SELF-PRIMING CENTRIFUGAL

INDUSTRIAL PUMPS



HIGHEST PUMPING EFFICIENCY . . . . .

Combines all the advantages of exact hydraulic engineering with the best mechanical design. Available in bronze fitted, all iron and all bronze construction.

Alta Pumps - Serving a capacity head-range up to 1000 g.p.m. and 200 ft. head with 14 sizes 1 to 4 inches. Practically no end thrust in ball bearings. No high pressure on stuffing box packing. High suction lifts without vibration and cavitation.

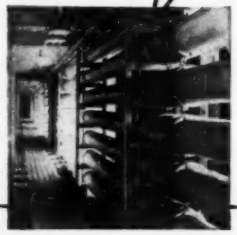
Pedestal Pumps - Pedestal is a strong casting suitable for direct connection to a motor or engine through flexible-coupling or heavy duty belt drives.

Write for bulletin 9-IP-11 and 8-IP-11

GORMAN-RUPP

THE GORMAN-RUPP CO., MANSFIELD, OHIO

ENGINEERED *for tomorrow*



. . . Badger EXPANSION JOINTS . . . assure long, trouble-free life . . . an engineering masterpiece

Leading textile plants are erecting ultra-modern buildings which are both *designed* and *engineered* for tomorrow. The structures represent the very latest trends in functional design . . . and the steam distribution systems must be engineered to perform with maximum efficiency. As you would expect, Badger Corrugated Packless Expansion Joints, constructed to the famous Directed-Flexing Self-Equalizing design, are first choice with these forward-looking companies.

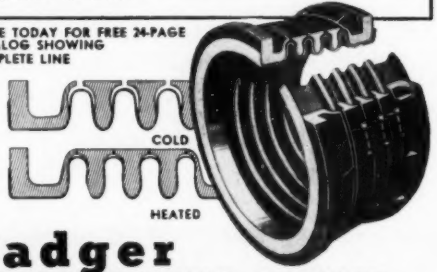
* * * * * *

What's the reason you find Badger Expansion Joints specified on *important* jobs? Because engineers have learned from years of experience to put their faith in the performance of Badger Joints . . . performance that's a result of construction features like these:

- Directed-Flexing Self-Equalizing rings . . . progressively control the movement of the all-curve corrugations.
- Packless . . . pressure-tight single tube — requires no maintenance.
- Compact . . . approximately the size of flanged fitting.
- Special forming . . . no structure-weakening stresses.
- Controlled heat treating . . . assures long life.
- Wide range of traverse — pressure — temperature.

Fabricated from deoxidized copper for normal pressures and temperatures, stainless steel or alloys to withstand high pressure, temperature and corrosion.

WRITE TODAY FOR FREE 24-PAGE CATALOG SHOWING COMPLETE LINE



Badger

MANUFACTURING COMPANY

230 BENT STREET, CAMBRIDGE, MASS.

Matching Power Plant Progress...

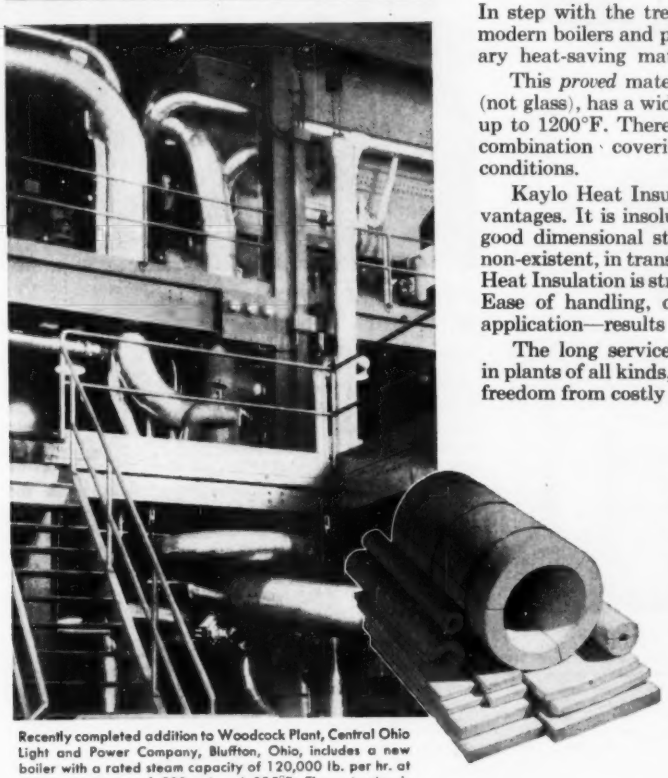
One Material Insulates The Entire Job–Better

In step with the trend toward greater efficiency of modern boilers and plant equipment is a revolutionary heat-saving material—Kaylo Heat Insulation.

This *proved* material, a hydrous calcium silicate (not glass), has a wide effective temperature range—up to 1200°F. Therefore, it eliminates the need for combination coverings in nearly all operating conditions.

Kaylo Heat Insulation has many additional advantages. It is insoluble in water; has exceptionally good dimensional stability. Breakage is practically non-existent, in transit or on the job. Although Kaylo Heat Insulation is strong, it is extremely light weight. Ease of handling, cutting and fitting helps speed application—results in a fast, neat and clean job.

The long service life of Kaylo Heat Insulation, in plants of all kinds, means continued efficiency with freedom from costly maintenance.



Recently completed addition to Woodcock Plant, Central Ohio Light and Power Company, Bluffton, Ohio, includes a new boiler with a rated steam capacity of 120,000 lb. per hr. at a design pressure of 500 psi and 835°F. The extension is insulated throughout with Kaylo Heat Insulation.

KAYLO HEAT INSULATING BLOCK is made in all standard sizes, up to 18″ wide and in thicknesses from 1″ to 6″. Where necessary, on special order, the block can be shiplapped for broken joint, single-layer application in thicknesses of 3″ or greater.

KAYLO PIPE INSULATION is made to Simplified Dimensional Standards of thicknesses and diameters for snug nesting, when needed. Coverings are sectional for tube and pipe sizes ¼″ to 12″; tri-segmental up to 23″; quad-segmental up to 41″; K-segmental (18″ wide segments) up to 72″ in diameter.

SEND FOR CATALOG

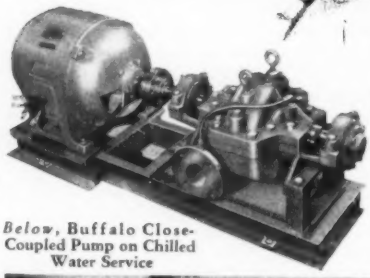
For complete details on Kaylo Heat Insulation, write Dept. N-194, Owens-Illinois Glass Company, Kaylo Division, Toledo 1, Ohio.

KAYLO® ... *first in calcium silicate*

...*pioneered by* OWENS ILLINOIS Glass Company

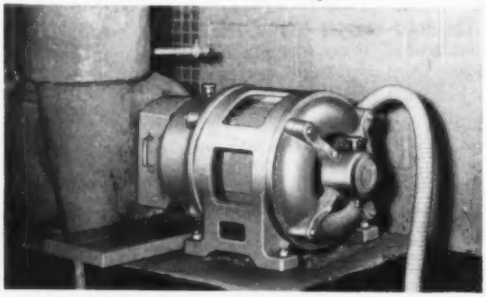
MAIN OFFICE: TOLEDO 1, OHIO—KAYLO SALES OFFICES: ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND DETROIT • HOUSTON • MINNEAPOLIS • NEW YORK • OKLAHOMA CITY • PHILADELPHIA • PITTSBURGH • ST. LOUIS • WASHINGTON

Haven't Had A Minute's Trouble Since We Put In "Buffalo" PUMPS



Left, Buffalo Class "RR" Pump for Boiler Feed and Other Clear Water Service

Below, Buffalo Close-Coupled Pump on Chilled Water Service



From on-the-job reports, we know that "Buffalo" Pumps are piling up savings in just this way. That's because they're built ruggedly—with extra heavy impellers, shafts, bearings and casings—all parts readily accessible for easy servicing. And inherent efficiency in every "Buffalo" Pump adds power savings to your maintenance savings. Best of all, in the "Buffalo" line, you can match the pump to *your* service and *your* conditions—there's a "Buffalo" Pump for almost every capacity, liquid and head required in industry. And each passes a thorough load test under specified conditions before shipment.

WRITE

for these free "Buffalo" bulletins! No. 955-N on Type "SL" Pumps, No. 980-B on Type "RR" Pumps and No. 975-B on "Buffalo" Close-Coupled Pumps.

BUFFALO PUMPS INC.
188 BROADWAY BUFFALO, NEW YORK
Canada Pumps Ltd., Kitchener, Ont.

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

Dutton EconoTHERM

"PACKAGED" STEAM GENERATOR WITH EXCLUSIVE OFF-CENTER FIRING

SHOWS BIG SAVINGS!

HERE'S WHAT OFFICIALS SAY AT W. B. PLACE & COMPANY, HARTFORD, WIS., CUSTOM DEERSKIN TANNERS:

"We are very much pleased with the Dutton gas-fired boiler . . . it has done an excellent job of heating, and been practically trouble free." As to cost of operation, *"our bills to date indicate a substantial saving . . . a big saving in labor."*

From the installation picture, you might compare the *appearance* of these boilers—but where *efficiency* begins, comparison ends! The compact Dutton EconoTHERM produces *160 h.p.*, against *90 h.p.* for the space-consuming old boiler beside it. From a cold start, the Dutton will produce 125 lbs. of steam pressure in just 15 minutes. The old unit took 2½ hours!

In Hartford—or wherever they're installed—"packaged" EconoTHERMS win praise for fuel efficiency, safety and durability. Delivering *twice* the power you'd expect in *half* the usual space, the EconoTHERM is self-contained, with fully automatic controls.

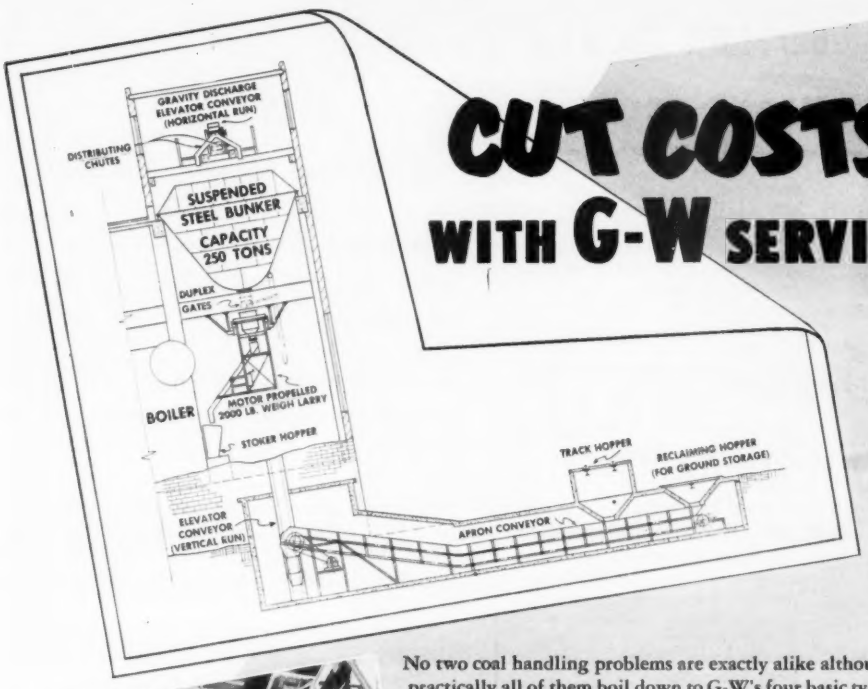
Exclusive Dutton "off-center firing" with rotary combustion gives you faster boiler water circulation, plus greater safety. Other features include: Large steam storage space . . . five or more square feet of water heating surface per rated h.p. . . . mechanical draft with short stack (no costly chimney) and choice of gas or oil firing.

Learn about *all* the quality features of the Dutton EconoTHERM . . . WRITE NOW FOR BULLETIN EC-100C

Other types and sizes — 5 to 250 h.p.

Dutton BOILER DIVISION
HAPMAN-DUTTON COMPANY
KALAMAZOO • MICHIGAN
Boiler Makers Since 1880

CUT COSTS WITH G-W SERVICE



No two coal handling problems are exactly alike although practically all of them boil down to G-W's four basic types of storage and handling.

For example, at a large U.S. Government arsenal, G-W designed and installed the suspended steel bunker with a gravity discharge bucket elevator shown at left. Coal is carried on the upper run of the conveyor, permitting free access to machinery and maximum bunker capacity. A cab-type weigh larry with recording beam provides clean, economical operation.

G-W conveyor system with capacity of 60 tons per hour. System consists of a Rail and Truck Hopper, a 30-inch Apron Conveyor, Gravity Discharge Elevator, 250-ton Suspended Steel Bunker and a 2000-lb. Weigh Larry.

4 BASIC WAYS TO CUT COAL HANDLING COSTS

No matter what your coal and ash handling problem is, from one of 4-basic types... Concrete Silos, Vitrified Tile Silos, Cylindrical Steel Tank, and Suspended Steel Bunker... G-W engineers can install the most efficient and economical storage and automatic handling system to fit your requirements of space, capacity and initial cost. Their recommendations to you, will be based on more than 140 years of design and engineering experience and on the performance records of hundreds of successful installations.

Fourteen interesting case histories, based on these 4 G-W basic designs, are described in Bulletin No. 300. Write for your copy, today.

GIFFORD-WOOD CO.

SINCE 1814

NEW YORK 17 — 420 LEXINGTON AVE.

Factory: Hudson, N. Y.

CHICAGO 6 — 565 W. WASHINGTON ST.

G-W HANDLES IT... faster • easier • cheaper

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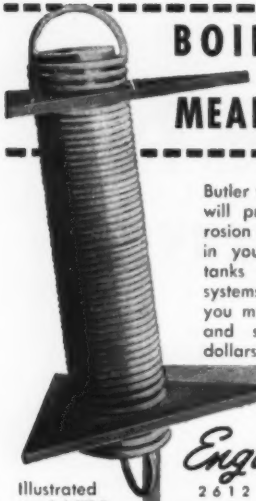

BOILER SCALE MEANS TROUBLE

Butler water conditioning unit will prevent scale and corrosion and remove old scale in your boilers, hot water tanks and associated pipe systems and fittings, giving you more efficient operation and saving you countless dollars.

BUTLER
Engineering Co.
2612 ROUSSEAU ST
NEW ORLEANS, LA.

Illustrated Model EZ-B for high and low pressure fire tube and water tube boilers.

There's a Butler DeScaler to solve your water conditioning problem from automobiles to ships including trucks, buses, Diesel Engines, evaporators, sterilizers, etc. Write for complete information.

NOTICE

About Your Power Handbook

Reprints of the Power Handbook (Parts I and II) are available now. Your order can be promptly handled.

It contains 64 fact-filled pages, and the price of single copies is $1.00, slightly less for quantities of 100 and over.

Send your order for the complete Power Handbook to: Power, Reader Service Dept., 330 West 42nd St., New York 18, New York.

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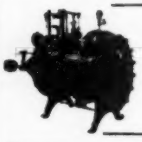

STERLING TRAPS
Return Traps—Lifting Traps
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Separating Traps
STERLING ENGINEERING & MANUFACTURING CORP.
TEMPLETON BROS.
110 Business Street
Hyde Park 36, Mass.

NEW TILTING STEAM TRAP
EASY TO BUILD—Pckg Unit—Proven Fuel Saver—Ideal Return System for Small Boilers. New-Market Developing in Oil Fields. Write
SS-1950, POWER
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BOILER BAFFLES
HIGH TEMPERATURE
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SANFORD C. SMITH REFRACTORIES, INC.
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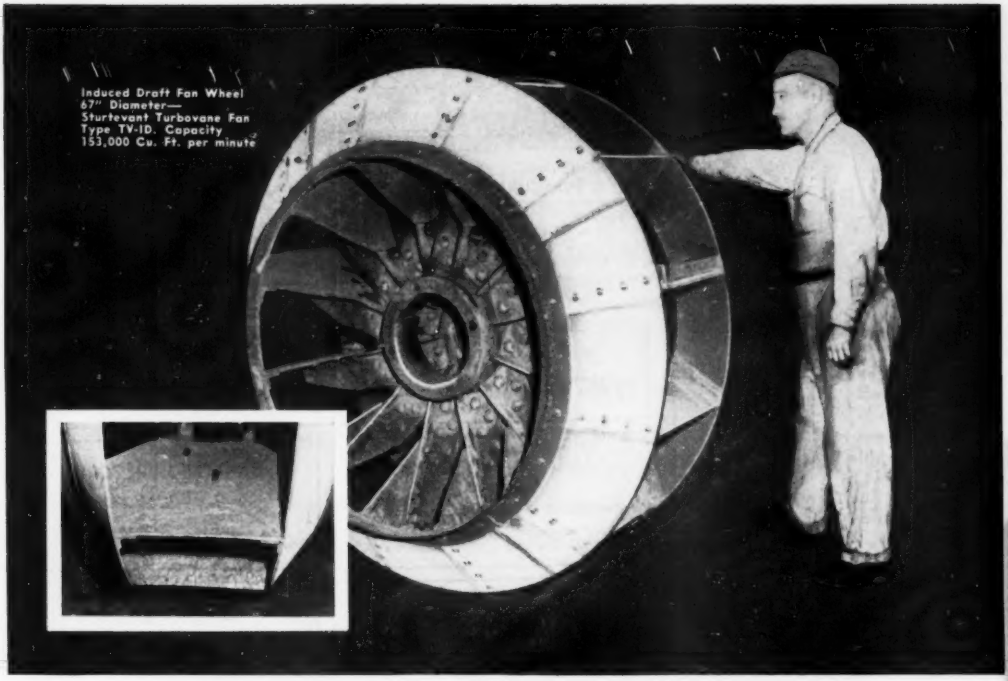
This WHERE TO BUY *Section*
supplements other advertising in this issue with these additional announcements of products and services essential to modern power plant operation. Make a habit of checking this page, each issue.
CLASSIFIED ADVERTISING DIVISION POWER



LIFE OF ID FAN BLADES HARD-FACED WITH COAST METALS ALLOY INCREASED FROM 4 to 12 MONTHS

2 Weeks Boiler Outage Eliminated With CM-112 Alloy

Maintaining this 67" induced draft fan wheel at New Jersey Power & Light Company's Gilbert Station in Holland, N. J. always meant one week of boiler outage three times a year. Labor involved in removing the wheel, changing over and reblading took two weeks for each overhaul. Now this is done only *once a year* by hard-facing the fan blades with Coast Metals Alloy 112. This has reduced downtime better than 66⅔ and eliminated 2 weeks of boiler outage at the station.

Fly ash in the exhaust handled by the fan not only wears down the blades but also attacks the junction points of the blades and shrouds weakening the assembly. In this severe case of abrasive action, CM-112 applied to the major points of wear has increased equipment life better than 3 to 1. Coated with 250 pounds of CM-112, the fan lasts one year before major overhaul. Minor touchups during the year are made while the fan wheel remains in the housing . . . on the job.

After one year of operation, the fan wheel can be refaced again . . . this time with about 60% less than the amount of CM-112 used in the initial hard-facing, resulting in a further reduction in maintenance costs.

There are many other examples of how CM Alloys extend the life of power plant equipment subject to impact and abrasion: Raymond Bowl Mill parts—coal feeder screws — sluice liner castings — clinker crusher rolls—impact mill plows—ID fan float liner plates, exhauster fan blades, when hard-faced with CM *stay on the job* and continue to perform efficiently *long after* unfaced parts have become too worn to use and must be replaced.

So don't' *replace — reface* with CM specialized welding rods. You'll not only keep your plant running with fewer interruptions, but save money. We shall gladly make recommendations based on your particular needs.

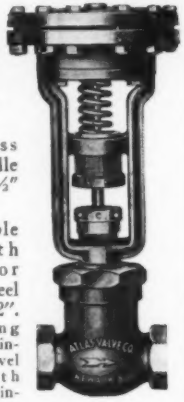
COAST METALS, Inc.

Little Ferry, N. J.

PRODUCERS OF SPECIAL HARD-FACING ALLOYS FOR THE POWER INDUSTRY

ATLAS

Type "D" Reducing Valves



For pressures up to 250 pounds, Steam, Air, Oil, or Gas Service.

Stainless Steel Needle Seats, Sizes ½" and ¼".

Renewable Disc with Bronze or Stainless Steel Seat, ½" to 2".

Regrinding Bronze or Stainless Steel Bevel Disc with Bronze or Stainless Steel Seat, ½" to 2".

Screwed Ends. Flanged Ends if desired. Diaphragm Operated. Bronze Bodies.

For complete information concerning ATLAS Type "D" as well as other Pressure Reducing Valves for steam, water, air, gas, or oil, ask for our 52-page Bulletin 1-A. The coupon below makes it easy to ask for 1-A or data on other ATLAS products as listed.

Type "D" is well liked by engineers for reduced working pressures from one pound to 150 pounds. Unexcelled for controlling the flow or pressure of steam, gas, hot oil or hot water where a simple tight seating valve is required.

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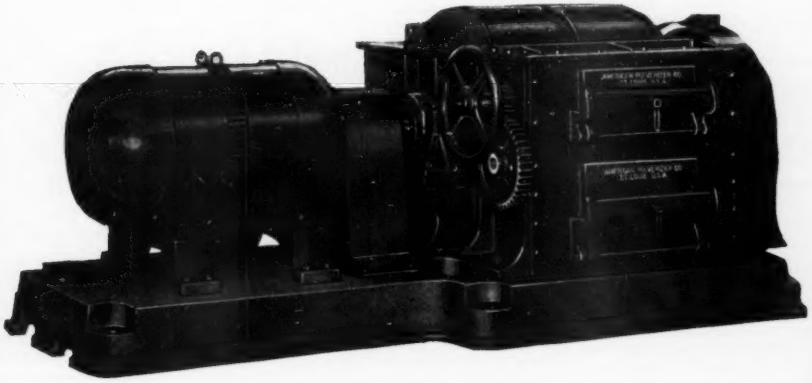
CASE HISTORY No. 1

"CRUSHING" FACTS on *American Crusher* PERFORMANCE

(Taken From An Independent Survey)

AC-7-C REDUCES 12" ROM COAL TO MINUS 1"—AT 550 TPH

"Operating at 10% Beyond Rated Capacity . . .
10% Under Power Capacity"



Here's the whole production story on this American AC-7-C, installed in a South Carolina Power Plant . . . reducing 12" ROM lumps to —1" at 50 tons per hour in excess of the factory-rated capacity of 500 tons per hour—and doing it on only 90% of the potential motor load!

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2000 GPM CENTRIFUGAL PUMP, Gould, 8", 236 ft. Head, Serial 131499.
Mounted on factory base and directly connected to 200 HP G.E. Induction Motor, 1745 RPM, Model 11-C-50, 2/60/2200, Serial 4819372. With Grids, oil switch, and switch.
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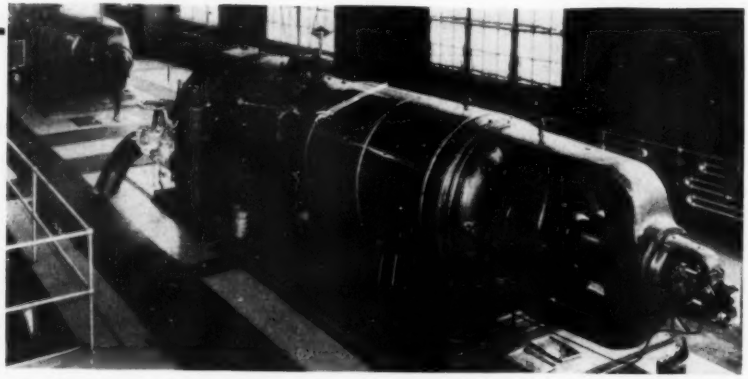
LOOK NO FARTHER

2500 KW. @ .80, 3125-KVA.

TWO (2) GENERAL ELECTRIC TURBO-GENERATORS

VERY HIGH GRADE UNITS : Are Duplicates

WILL PASS RIGID INSPECTION



Above View shows our Two (2) General Electric Turbo-Generators on present Foundations. They are 2500 KW @ 80% PF, 3125 KVA, both are complete units with (2) Surface Condensers, Exciters, and all auxiliaries. Steam 160/225# psig, 450° FTT, 2300, 4160, 6900 V.

BULLETIN #900 in Colors has specifications and Complete Data on above Units. SEND FOR IT TODAY.

A PARTIAL LIST OF TURBO-GENERATORS IN OUR STOCK IS GIVEN BELOW

12,500-KVA G.E., CONDENSING Complete A-1

6,250-KVA G.E., Complete Condensing Unit Condition: Excellent, 200# PSIG, 2300/4160 V High Grade Unit

3,750-KVA G.E. 150/250# PSIG, 480 Volt Limited use since Rebuilt A-1

3,750-KVA G.E. modern 440# PSIG, 750° FTT 2300 Volt. Rare unit.

3,125-KVA 160/225# psig, 2300 Volt
See above Cut and description (2)

3,125-KVA G.E. 200# psig, 2300 V. OK

2,500-KVA G.E. 150/200# psig, 2300 V

2,500-KVA, Westg. 250/350# psig, 2300 Volt, Non-cond. Like New Unit. Back P. 40/50#. Modern. Any Insp.

1,875-KVA Allis-C, 150-200# psig 2300 V. Rebuilt by Allis Co.

1,875-KVA Allis-C, 150/250# psig 2300 V. Very Good

1,250-KVA, Allis-C, 200# psig. Rebuilt Excellent condition A-1

937-KVA G.E., 150# psig, 480 V Rebuilt

1,000-KVA 440# psig, 750° FTT, Condg. New, never uncrated G.E. 480 V

937-KVA Allis-C, 125/200# psig 480 V, Rebuilt, New Coils No. 1

625-KVA, Westg. 250# psig, Non-cond. 125#, B.P. Like New Machine

625-KVA, G.E., 125/175# psig 480 V A-1

ALL ABOVE TURBINES ARE IN STORAGE: IMMEDIATE DELIVERY

COMPLETE DATA IS IN OUR FILES: INSPECTION REPORTS, DRAWINGS, ETC. ARE YOURS FOR THE ASKING

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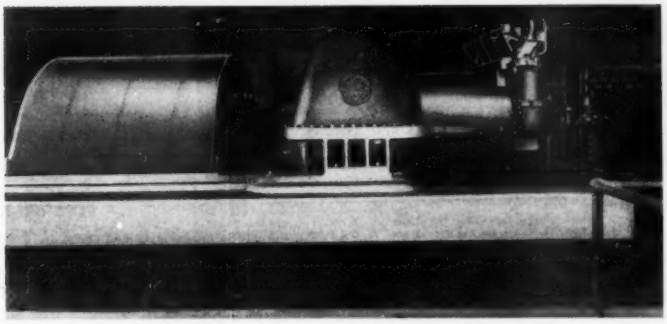
FOR TURBINE GENERATORS BOILERS, DIESEL POWER

3000 KW .80 3750-KVA. GENERAL ELECTRIC CONDENSING TURBO-GENERATOR

A MODERN HIGH PRESSURE HIGH TEMPERATURE UNIT



The above Reproduced Photograph Covers a Very Modern General Electric, Form GG., 14-Stage, 3000 KW @ 80% PF, 3750 KVA, Turbine-Generator, a design very seldom on the market. It is a 400# psig, 750° FTT, 3/60/2300 volt, condensing, in excellent condition in every way. Is served by a Surface Condenser and is a complete installation. FULL DATA ON REQUEST.

OUR OCTOBER SPECIALS

2,500-KVA, Westinghouse Non-Condensing Turbo-Generator, Steam 250/400# psig, 40# Back P, 50# BP with changes 3/60/2300-V. Limited Service: Modern. Like a New Unit. Ask for Inspection Report.

6,250-KVA, General Electric Condensing Turbo-Generator, A complete Machine with Surface Condenser and all appurtenances. Steam 200# psig, 600° FTT, 3/60/2300-4160 Volt. Condition: Ready for installation with no repairs. Send for inspection Report and Data. Deliver Duty Free any point in USA or Canada. Investigate.

OFFERINGS FROM OUR STOCK ARE NOTED BELOW

BOILERS: B & W, 850# psig, exhausting 100,000# steam per hour. Combustion Engineering Co. 450# psig, 70,000# steam per hour. These Boilers are in excellent condition. Will pass rigid inspection. Immediate Delivery. Full data on request. Many other high grdae Boilers available. Send us your specifications. Space does not permit listing them here.

TURBINE-GENERATORS: LARGE CAPACITIES: 25,000 KVA, G.E. 15,000 KVA, G.E., 12,500 KVA G.E. ALL condensing units, complete with all auxiliaries. We have complete data on file and will be pleased to forward it to any interested parties. Prompt investigation is suggested.

INVESTIGATION IS INVITED ON ALL OF THE ABOVE. ALSO ON TURBINES LISTED ON THE OPPOSITE PAGE. ALL GOOD MACHINES.

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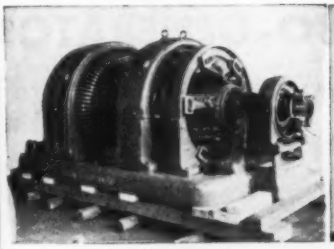
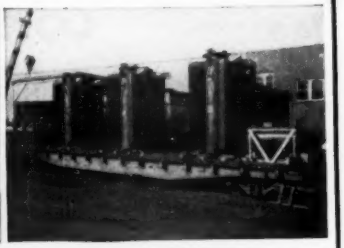


1000 KW MG SET

1000 HP 189.5 RPM SYNCHRONOUS MOTOR



3—667 KVA TRANSFORMERS

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
2	2000*	G.E.	500		6600/11000
1	1500	G.E.	720	600	6600/13200
1	1500	Whse.	600	600	2300/4600
1	1500	G.E.	360	275	2200/4400
1	1000	G.E.	900	600	6600
1	1000	Whse.	900	600	2300/4150
1	1000 (3U)	G.E.	900	250	2400/4800
1	750	Whse.	900	250	2300
1	500	G.E.	900	600	4150
2	500	Whse.	900	250	6600/13200
1	500	Whse.	1200	125/250	2300
1	500	G.E.	720	125	2300/4000
1	400	G.E.	720	250	440/2300
1	400	Whse.	1200	250	2300
1	400	G.E.	900	275	2300/4150
1	250	G.E.	900	125	2300/4150
1	240	G.E.	1200	250	2300
1	300	A.C.	1200	240	2300
1	150	G.E.	1200	250	2300
1	150	Whse.	1200	275	2300
1	150	G.E.	1175	125	440
1	140 (3U)	Cr. Wh.	690	125/250	2300
1	100	G.E.	1170	125	220
1	100	Delco	1200	125/250	440
1	75	G.E.	1200	125	4000
1	75	G.E.	1200	250	440
6	70	G.E.	1200	70	220/440

*25 Cycle

ROTARY CONVERTERS

60 Cycles

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1—2000		G.E.	514	600	13800
1—1000		Whse.	900	600	11000

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	6000	Al. Ch.	Condensing 200/250 ISP 2300/3/60-Exc. & Surface Cond.
1	2500	G.E.	Auto. Ext. Cond. 800 lbs.-800* F.T.T. 175/200 Auto. Ext. 2300/3/60 Exciter & Surface Cond.
2	1000	G.E.	Non-condensing. 175/200 lbs. I.S.P. 5/20 lbs. G.B.P., 480/3/60.
2	750	G.E.	Condensing 425#-725°TT ISP-440 V-3 ph. 60 cy. New — 1941
1	625	Whse.	Non-condensing. 125/150# ISP 5/20# B.P., 480 v., 3 ph., 60 cy., with exciter
2	500	G.E.	Non-condensing 175/200 lbs. I.S.P., 5/30 G.B.P., 480/3/60.
1	460	Whse.	Non-condensing 125/150# ISP 5/10# G.B.P. 240/480v. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175# ISP 5/15# B.P. 480V., 3 ph. 60 cy.
1	300	Al. Ch.	Condensing 425# ISP Geared to 1200 RPM 120/240V. D.C.
1	200	Whse.	Non-condensing 150# ISP 7# B.P. 240 V. 3 ph. 60 cy.

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—2200	G.E.	MCF	600	360/500
1—1750	West.		600	525/720
1—1500	Whse.		525	600
1— 940	Whse.	QM-R. Brg.	250	140/170
1— 800/1000	Whse.		450	600/720
1— 600	Al. Ch.	MILL	330	400/800
2— 450	Whse.		550	415
1— 300/400	G.E.	DYNA	250	1325/2500
1— 350	Cr. Wh.	CCM-151H	230	1100
1— 335	Whse.	MQ	250	300/900
1— 200/300	G.E.	MPC	230	360/920
1— 250	G.E.	MPC	230	400/500
1— 150	G.E.		600	250/750
10— 150	Cr. Wh.	83H	230	890
1— 150	Cr. Wh.	CMC-65H	230	1150
1— 150	Whse.	8K-201	230	350/975
1— 50/120	G.E.	MFC	230	250/1000
4— 75	G.E.	TLC-50	250	850/2500

FREQUENCY CHANGERS

Qu.	KW	Make	Cycles	Voltage
1—3000		G.E.	25/60	4000/2300x2300/4000
1—1000		A.C.	25/62½	2300/2300
1—1000		G.E.	25/58	4400/2300
1— 500		A.C.	25/60	11000/2300V

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Volts	Speed
1	5000	Whse.	4150	600

TRANSFORMERS

60 Cycles

Qu.	KVA	Make	Type	Ph.	Voltages
2	4000	G.E.	HT	3	22000x2300
3	1250	G.E.	H	1	6600x700
1	500	Whse.	OISC	1	34630x432
1	500	Whse.	OISC	3	13400x216
4	333	G.E.	HKDD	1	6900/13800x230/460
6	300	G.E.	HT	3	13200x240/180
2	200	G.E.	HT	3	6900x240/480
9	300	G.E.	HT	3	2400x240/480
3	150	Pitts.	OISC	1	4800x240/120
3	100	G.E.	OISC	1	2400x120/240
3	75	Pitts.	OISC	1	480x120/240

RECTIFIERS

1— 750	G.E.	BHW	575	2300
1—1000	A.C.	B-612	625	13500
1—1000*	A.B.B.	GRZ	625	6600/13200

*This unit with full automatic control good for both 25 and 60 cycle.

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—6500	G.E.	TS	2300	257
2—2000	Whse.		2300	120
2— 900	Al. Ch.	(New)	2200	150
2— 735	G.E.	ATI	2200/12000	600
1— 650	Whse.	G	2200	138
1— 500	G.E.	TS 7657	2400/4800	600
1— 450	Whse.	Eng.	2200	128.5
2— 350	G.E.	TS	2200	150
1— 300	Whse.		2300	720
1— 125	G.E.	ATI	440	450
1— 100	Whse.		550	600

SLIP RING

1—1000	Whse.	CW	2300	444
2— 500	G.E. unused	M-574Y	2200	900
1— 500	G.E.	IP	550	505
1— 500	G.E.	IM-MIII	2200	450
1— 500	G.E.	IM	440	900
1— 350	G.E.	MT442-Y	2200/4000	253
1— 300	Al. Ch.	3 Brg.	2300	505
1— 300	G.E.	IM	440	720
1— 300	Al. Chal.	ANY	2200	708
1— 250	Al. Chal.	ANY	440	865
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-5598	2200	1750
1— 250	Al. Chal.	ANY	550	600
1— 200	G.E.	MTP	440	1170
1— 150	F.M.	H.V.	2300	1755
1— 150 new	Whse.	CW	2300	450
4— 125	G.E.	MT-566Y	440/2200	435
4— 100	G.E.	MT-566Y	440/2200	425
1— 100	G.E.	IM-16	2200	435
2— 100	G.E.	IM	440	600
3— 100	Al. Ch.	ANY	440	695
1— 100	G.E.	MT556	2200	900

SQUIRREL CAGE

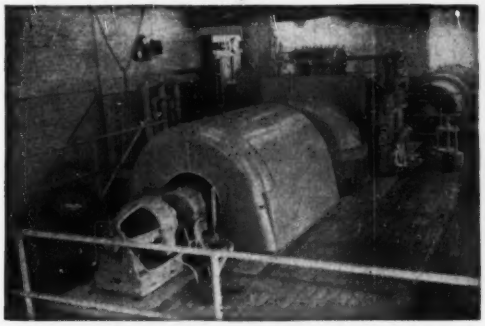
2— 650	G.E.	FT3503Y	440	3750
2— 450	Whse.	CS	2300/4150	354
1— 300	G.E.	KT-574Y	2300	505
1— 200	G.E.	IK-17	440	580
1— 200	G.E.	KT557	440	1800
1— 200	G.E.	IK	440	865
1— 150	Welghse.	C88568	440	880
1— 125	Whse.	MS	440	485
1— 125	(New) G.E.	KF-TEFC	440	1190
1— 125	G.E.	KF-TEFC	440	3585
3— 125	Al. Ch.	ARW	2200	1750
1— 100	G.E.	IK-Vert.	2300	450
2— 100	G.E.	KT-512	220/440	1750
1— 100	G.E.	KT-558	440	900

RE NU BILT BELYEA MOTORS

BELYEA COMPANY, Inc.

43 HOWELL ST., JERSEY CITY, N. J.
PHONE—JOURNAL SQUARE 2-3334
N. Y. LINE—RECTOR 2-7150

• TURBO GENERATORS •

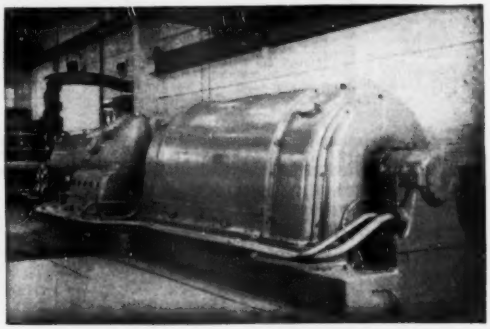


Actual Photo—2500 KW

GENERAL ELECTRIC TURBO UNIT

TURBO: 2500 KW, 3600 r.p.m., Form AA, 11 stage, 800 lbs. ISP, 750° FTT, 200 lbs. G.
AUTOMATIC EXTRACTION, 2½" abs. condensing.
GENERATOR: 2500 KW, 3600 r.p.m., 3125 KVA, 80% p.f., type ATB-2 form T, 3 phase, 60 cycle, 2300 volt.
EXCITER, 25 KW, 125 volt, 3600 r.p.m. direct connected. Complete operating panel.
CONDENSER: Alberger, surface type, 2 pass, complete with circulating, condensate and air removal pumps.
WATER RATES: Calculated at 800 lbs. I.S.P., 750° F.T.T., and 2½" abs.—KW—Lbs. per KW Hr.

3125 KVA	10.89	1875 KW	11.22
2500 KW	10.89	1250 KW	11.92



Actual Photo—6000 KW

ALLIS CHALMERS TURBO UNIT

TURBO: 6000 KW, 3600 r.p.m., 200/225 lbs. I.S.P., 550° F.T.T., 2½" abs., condensing.

GENERATOR: 6000 KW, 3600 r.p.m., 7500 KVA, 80% p.f., 3 phase, 60 cycle, 2300/4100 volts.

EXCITER: 50 KW TURBO UNIT, 125 volt complete operating panel.

CONDENSER: ALLIS-CHALMERS, Surface type, 2 pass, complete with circulating, condensate and air removal pumps.

This installation may be purchased in its entirety or in parts, and we will be pleased to supply additional information upon inquiry. The 2500 KW G.E. Electric Unit served as a topping installation for the 6000 KW Turbo Unit; and associated equipment included one

• B & W STIRLING BOILER •

100,000 lbs. per. hr., 800 lbs. pressure, 800° F.T.T. complete with pumps, pulverizers, gauges, valves, and standard trim.

Recently Acquired Geared D.C. Turbo Units

2—1000 KW—G.E.—Non-Condensing 200# ISP—100° S.H.—5/20# B.P. 480/3/60.

1—1000 KW—Moore-GE. Condensing Mixed Pressure—200# ISP—100° S.H. 250V. D.C.

2—500 KW—G.E. Non-Condensing 200# ISP—100° S.H. —5/10# B.P.—250V. D.C.

Photo at left shows installation can be inspected as shown.

BELYEA COMPANY, INC.

43 HOWELL STREET JERSEY CITY 6, N. J.

here's the reason...

. . . YOUR INQUIRIES ARE PROMPTLY ANSWERED

FINGERTIP INFORMATION

Our staff is capable of providing you with information and specifications on all types of jobs. From the minute your job enters the door to the day it is shipped a "fingertip" record is kept to guide it through our plant. Our staff also keeps a running inventory of "stock-on-hand" and on available equipment throughout the country to assure fast and efficient fulfillment of your needs.

GUARANTEED REBUILT POWER EQUIPMENT

HERE'S A WIDE SELECTION FROM OUR GIANT STOCK

SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

H.P.	Make	Type	Speed
1000	*G.E. (New)	K6347S	1800
750	*G.E.	KT	720
550	*G.E.	KP-559	3600
500	*G.E.	FBG	1800
500	*Fr-Morse	HS	1200
450	*G.E.	KP-567S	1200
400	*Cont. (New)	NZ	1800
400	*A.C.	ARWW	900
400	*G.E.	IK	514
350	*Cr.-Wh.	84	3600
300	*Westgh.	CS	3600
300	G.E.	IE-K	1200
300	A.C.	AB	900
300	Westgh.	CS	514
250	West. (New)	CS	1800
250	*L.-Allis	OGX-1488	720
250	Westgh.	CS	600
200	*G.E.	IK-13B	1800
200	*G.E.	IK	514
150	G.E.	KT-546	1800
150	G.E.	IE	1800
150	G.E.	KTP	1200
150	Westgh.	CS950A	600
125	West. (New	CS504	3600
125	*A.C.	AR-226	1800
125	G.E.	K6326S (TEFC)	1200
125	A.C. (New)	AW	1200
125	G.E. (New)	K6333	900
100	A.C. (New)	ARWWT	3600
100	*G.E.	FT542Z	1800
100	G.E.	FTRP	1800
100	*Westgh.	CS	1800
100	A.C. (New)	AW	1200
100	Reliance (New)	AAC (TEFC)	1200
100	U.S. (Vert.)	CFU	1200
100	G.E.	KT558S	720
75	West. (New)	CS5058	1800
75	G.E.	KT-346	1200
75	Triumph	TR16	514
75	G.E.	IK	600
75	G.E.	IK	514
60	*Westgh.	CS504	1800
60	G.E.	KT533	1800
60	A.C. (New)	APZ445S (TEFC)	1800
60	A.C. (New)	AH8230	900
60	A.C.	AH828P	514
50	A.C. (New)	APZ444 (TEFC)	1800
50	West. (New)	CS-443 (TEFC)	1800
50	G.E.	KT527	1800
50	U.S. (Vert.)	8CV75F	1800
50	West.	CS604	1800
50	Howell (New)	K-504 (TEFC)	1200
50	G.E.	KT-336	1200
50	Westgh.	CS-250	1200
50	G.E.	KT343	1200
50	*G.E.	KT342	900

SLIP RING MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

H.P.	Make	Type	Speed
2500	*G.E.	MT	257
1200	*Cr.-Wh.		240
800	*A.C.	3 Brg.	450
650	Westgh.	HE	350
500	*G.E.	IM17B	900
500	Westgh.	CW	350
400	A.C.	3 Brg.	450
400	*G.E.	MT-412	450
350	*G.E.	IM-15	1800
300	*G.E.	MT-410	450
250	*G.E.	MT-422	300
200	G.E.	IM	1800
200	*G.E.	IM-16	600
150	*G.E.	IM-16	600
125	*G.E.	MT-549	1800
125	G.E. (New)	M4333	900
125	G.E. (New)	M6334	720
100	A.C.	ANY	900
100	Westgh.	CW	600
100	G.E.	IM	450
75	*A.C.		900
75	Star	08OO	900
75	G.E.	IM-14	600
60	G.E. (New)	M585	1200
60	Westgh.	CW	900
50	G.E.	IM11A	1800
50	A.C.	ANY	1800
50	Westgh.	CW	1200
50	G.E.	MT346	720
50	G.E.	IM	600
50	G.E.	IM14	425
40	G.E.	MT336	1200
40	Westgh.	CW644	900
40	G.E. (New)	M504U	900
35	Fr-Morse (Vert.)	UAB	1800
35	G.E.	IM	1200
30	G.E.	MT502	900
30	Westgh.	CW445	900
25	G.E.	IM-11	1200
25	A.C.	ARY220	900

SLIP RING MOTORS

Crane and Hoist Type 30/60/220 or 440 volts

H.P.	Make	Type	Speed
75	Westgh.	C1756A	600
50	GE	ITC-5013	900
50	Westgh.	MW-334	600
25	Westgh.	C1572	900
20	Westgh.	CI	900
15	G.E.	ITC5010-25 Cy.	720
11	Westgh.	C1464	900
6⅔	R & M	425A (TENV)	1200
5	G.E.	MTC-5730	1800
3	G.E.	MTC5160	1200

AIR COMPRESSORS

Size	Make	Type	Displ.	PSI
9x9	Worth.	HB	211	100
9x8	Ing.-R	ER-1	145	100
8½x9	Worth. (New)	HB	170	100
		HB	122	100
7x7	Worth.			

AC SYNCHRONOUS MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

H.P.	Make	Type	P.F.	Speed
800	G.E.	TS944	1.0	1800
750	*Westgh.		.8	900
700	G.E.	TS		514
320	*A.C.	Dr Pf	1.0	720
300	Cr-Wh.	ENG	1.0	300
300	G.E.	ATI-9	.8	900
250	*A.C.	Dr Pf	.8	720
220	G.E.	ATI	1.0	600
100	El. Machy.	Ped	1.0	450
150	El. Machy.	EM	.8	720
150	*Westgh.		1.0	300
125	Parkinson			900
125	*El. Machy.	SYN	1.0	900
125	Cr-Wh.	103S	1.0	900
125	*G.E.	TS	1.0	277
118	El. Machy.	EM	1.0	240
100	Cr.Wh.	102S	.8	900
100	*G.E.	ATB	.8	900
100	Ideal	SM8	1.0	900
75	G.E.	ATI	1.0	900
60	G.E.	TS7536	1.0	1200
40	G.E.	ATB	.8	1200
20	Fynn-W.	15VBN		1200
15	Century	ARC305	1.0	1200
4	G.E.	AK 25 Cy.		1500

DIRECT CURRENT MOTORS

230 Volts

H.P.	Make	Type	Speed
1000	Westgh.	(600V)	400/800
400	Westgh.		600/1200
375	Westgh.	Ped	650
200	Westgh.	SK210	800
175	Reliance	1407F	675
175	G.E.	ELC111	750
125	G.E.	Marine	1200
100	G.E.	RC34	2500
100	Westgh.	SK173	850
100	A.C.	EL52	575
48	Cr-Wh.	CMC	1750
40	G.E.	C02304	600
35	Cr-Wh.	CM351	700
35	G.E.	C	600
30	Westgh.	SK120	975
30	Cr.Wh.	CCM	450
30	Westgh.	SK933	1750
30	G.E.	RC 31B	1150
25	Westgh.	SK113	850
25	Westgh.	SK100L	1150

MANY OTHERS—1 HP and UP! ALSO 115 VOLT

D. C. MOTORS—ADJUSTABLE SPEED

230 Volts (*115 Volt)

H.P.	Make	Type	Speed
50	G.E.	C	300/900
30	Westgh.	SA-8	500/1500
20	Westgh.	SK-110L	500/1500
20	A.C.	ER-145	300/1200
15	*Triumph	Planer	225/900
12.5/15	G.E.	RC-116	500/1500
10/15	Reliance	185T	400/1600
10	*Elec-D	7½S	300/1200
10	G.E.	RF-11A	300/1200
10	G.E.	RD-10A	600/1800
10	Westgh.	SK-100	400/1600
10	G.E.	CR-10	450/1350

DIESEL-GENERATORS (2)

NEW—31.25 KVA Rogers AC Generators, 3/60/120/208, D/C Exciter driven by direct-connected Cummins Diesel Engine, Model H-1. Complete Control Panel.

HI-PRESSURE PUMPS

GPM	Make	Type	Head
800	Worth.	6D8	925-Ft.
500	Manistee	H	250 Ft.
300	Al.Ch.	NMZ	800 Ft.

ROTARY CONVERTER

1000 KW Westinghouse, 900 RPM, 600 Volt DC; 6 phase, 60 cycle AC, with complete automatic control.

AC SYNCHRONOUS GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

KVA	Make	Type	P.F.	Speed
1500	G.E.	ATI	.8	900
1000	*Westgh.	203D	.8	900
250	*Al-Ch. (New)		.8	720
150	El. Machy.	EM	.8	720
112.5	*G.E.	ATB	.8	1200
110	Cr-Wh.	103	.8	900
100	*G.E.	ATB	.8	900
60	Fr-Morse	B	.8	900
55	G.E.	ATB	.8	1200
50	G.E.	ATB	.8	1200
50	Westgh.		.8	1200
50	Cr-Wh.	508S	.8	1200
37.5	Al-Ch.	EA121	.8	1800

TRANSFORMERS

3—2000 KVA Pittsburgh, 1 Phase 12,000 V to 2300 V.

1—750 KVA Westinghouse, AIR—3 Phase 13,800 V to 480 V

1—750 KVA Westinghouse—AIR—3 Phase 13,800 V. to 2300/4160 V.

3—667 KVA Niagara, 1 Phase 13,000 V. to 480 V.

3—300 KVA General Electric, 3 Phase 13,800 V. to 240/480 V.

3—300 KVA General Electric, 3 Phase, 2400 V to 240/480 V.

1000 KW MOTOR-GENERATOR SET—3-UNIT

2—500 KW Westgh. DC Gens., 275/137.5 V. 3 wire, 1820 Amps. D/C TO 1420 HP Westgh. Syn. Motor, 900 RPM 11,000 V. 60 Cy., 3 Ph. 3 Brg. on Castiron Factory Base.

MOTOR-GENERATOR SETS

K.W.	Make	A.C.	D.C.
500	Westgh.	2300	250
500	Westgh.	550	250
500	Cr-Wh.	220/440	250
450	G.E.	2300	125/250
400	Westgh.	2300	600
250	West-GE	440	250
200	CrWg.	440	250
200	Ridgeway	2200	250
150	G.E.	2300/400	250
150	G.E.	440	250/275
150	Cr-Wh.	440	250
150	Al-Ch.	220	125
100	G.E.	440	250
100	G.E.	220	250
100	G.E.-Delco	440	120/240
75	Al-Ch.	440	250
75	Westgh.	2300	110
60	Al-Ch.	2300	110
40	Cr-Wh	220	125

First Source for 41 Years for Quality Electrical Equipment

CHICAGO Electric Co.

1320 W. CERMAK ROAD — CHICAGO 8, ILL.

MOTOR GENERATORS

2—300 KW G.E. Syn. 250 V. 1200 RPM
1—300 KW WEST. Syn. 250 V. 1200 RPM
1—200 KW G.E. Syn. 250 V. 1200 RPM
1—200 KW WEST. Syn. 600 V. 900 RPM
1—200 KW RIDGWAY Ind. 250 V. 900 RPM
2—150 KW G.E. Syn. 250 V. 1200 RPM
1—150 KW WEST. Syn. 250 V. 1200 RPM

ROTARY CONVERTERS

1—500 KW G.E. Syn. 250 V. 1200 RPM
1—300 KW G.E. Syn. 250 V. 1200 RPM
1—300 KW WEST. Syn. 250 V. 1200 RPM
1—150 KW G.E. Syn. 250 V. 1200 RPM
1—150 KW WEST. Syn. 250 V. 1200 RPM
2—100 KW G.E. Syn. 250 V. 1200 RPM

ARMATURES

1—500 KW G.E. 250 V. Generator 900 RPM
1—300 KW G.E. 600 V. Converter 1200 RPM

WALLACE E. KIRK COMPANY
502 Grant Bldg., Pittsburgh 19, Pa.

AMERICAN
Famous for Fine
REBUILTS
Since 1902

NEW PORTABLES WORTHINGTON
315 DIESEL—4 PNEU
105 GAS—4 PNEU
105 GAS—2 PNEU

WE SPECIALIZE IN OIL-LESS COMPRESSORS

RENTAL
273 AIR COMPRESSORS AVAILABLE
RENTAL PURCHASE
GAS — DIESEL — ELECTRIC

AMERICAN AIR COMPRESSOR CORP.
Dell Ave., & 47th North Bergen, N. J.

COMPLETE DIESEL PLANT

3—575 HP F.M. 5 cylinder, 400 RPM. 383 KW F.M. 3/60/2300 alternators. Woodward governors, heat exchangers and complete plant auxiliaries. For sale in whole or part. Condition excellent.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis 1, Mo.

TURBO GENERATING UNIT

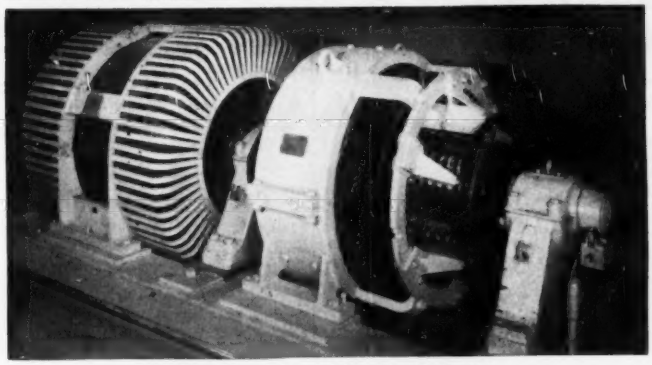
1—100 K.W., G.E. Non-condensing, 3600 RPM. #27,160, 3 ph., 60 cy. 600 volts. (Can be reconnected 480 volts full capacity. Can be reconnect to 240 volts at rating 100 KVA.) Dir. Ctd. exciter.

60 CYCLE MOTORS

1—250 H.P., G.E. slip ring, 3 ph., 60 cy., 2400 volt, 1800 RPM. two bearing self contained, with shaft for coupling.

2—50 H.P., G.E., slip ring, Type MT 356, 3 ph., 60 cy., 440 volt, 600 RPM.

ARCHER & BALDWIN, INC.
75 West Street New York 6, N. Y.
Tel: BO. 9-9275-9276



500 K.W. Westinghouse Motor Generator Set

MOTOR GENERATOR SETS
Philadelphia Stock

1—1000 K.W. Westinghouse 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Motor .8 P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels Modern Unit—Can furnish 60 cycle 2300 or 13200 volt.

1—600 KW G.E. MPC—2400 amp. 230 volt 514 RPM with 1050 H.P. G.E.—ATI Syn. Motor .8 P.F. 2 phase, 60 cycle, 2300 volt A.C. & D.C. Panels—Can furnish 3 ph. 550 V. or 2300 V.

2—500 KW Westinghouse 250 Volt 900 RPM with 720 H.P. West. Syn. Motors 3/60/2300/13200 volt, Serial #8130447-48 (year 1935) See actual photo above.

1—500 K.W. Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Sym. Motor 3/6/2300 V. A.C. & D.C. Panels.

1—450 K.W. G.E. Type CY-225 (1941 year) 250 volt 1200 RPM direct connected 650 HP GE-ATI-Syn. Motor 3/60/480 volt. Magnetic Red. Voltage Starter.

3—300 K.W. West. 3 wire 125/250 Volt 1200 RPM Generators (1938 year). Can furnish with suitable motor as single unit or as 600 K.W. 3 Unit Set. Advise Requirement.

1—300 K.W. Elliott 250 Volt 1200 RPM with 500 H.P. Syn. Motor 3/60/2300/1200 RPM—Automatic Controller & D.C. Panel.

2—150 K.W. G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels.

1—150 K.W. West. SK 184, 3 wire 125/250 Volt 1200 RPM (1938 yr.) 250 H.P. West. Syn. .8 P.F. 2/60/220 or 3/60/220/440/550/2300 V.

1—100 K.W. Al. Chalmers 250 Volt 1200 RPM 150 H.P. Syn. Motor 2/60 or 3/60 any voltage.

1—100 K.W. G.E.—C.D.—125 Volt D.C. 150 H.P. GE Syn. Motor, 3/60/220/440/1200 RPM.

1—75 K.W. Burke 250 Volt, 900 RPM 113 H.P. Burke—Syn. M.D. 2 or 3 phase, any voltage.

1—75 K.W. G.E. DLC—250 Volt, 1200 RPM, 110 H.P. Sq. Cg. 3/60/220/440 V.

Smaller Sizes and Types—Advise Requirements.

ELECTRIC MOTORS

Q.	H.P.	Make	Type	Volts	Speed
1	1200	Cr. Wh.	Sl. Rg.	2300	257
1	700	G.E.	ATI (syn)	480	1200
2	600	West.	Syn.	440	257
3	500	West.	CS	6600	514
1	400	G.E.	Syn.	2300	450
1	400	West.	CW	440	514
1	350	G.E.	MT18	2300	400
1	315	G.E.	Syn.	2200	720
1	200	West.	Syn.	2300	1200
1	200	West.	MW	440	600
1	150	Ideal	Syn.	220	1200
1	125	West.	Syn. (3 brg.)	550	600
1	125	Cent.	SC	440	1800
2	100	G.E.	Syn.	440	300
1	75	West.	CW	440	1200
1	60	West.	CW	440	720
1	50	West.	CS	440	3600
2	50	Cent. (new)	SC	220	1200
1	40	G.E.	MT536	440	900
1	30	G.E.	MT532	440	900
2	25	G.E.	MT332	440	900

DIESEL GENERATORS

2—1250 KVA GM 3/60/2300/720 RPM complete Plants—Used 4 years.

1—1000 KVA Hamilton 99 DA 3/60/2300/4160 600 RPM—New 1943—Never used.

1—625 KVA Baldwin—Series 600 3/60/2300/514 RPM—New 1948—1500 hours.

1—225 KVA General Motors, Twin 671, 3/60/440. —New 1941.

AIR COMPRESSORS

1—12,000 CFM Ingersoll-Rand Turbo Compressor, 3.25# pressure, 250 HP, 3/60/440/3600 RPM.

1—1050 CFM Ingersoll-Rand ES1, 17¾x13, 50 lb. PSI, 275 RPM, V-belt.

1—880 CFM Worthington Syn. motor drive 150 H.P. 3/60/440/277 RPM, size 17x19½x12.

2—528 CFM Chicago NSB, 100 lb., 285 RPM V-belt 14x12.

2—368 CFM Ingersoll ER-1, 285 RPM, 100 psi., 50 HP direct gear, M.D. 3/60/220.

1—360 CFM Schramm Vertical V belted on steel base, 75 HP motor 3/60/220

1—277 CFM Chicago PB4 Air Cooled 50 HP V-Belt Motor Drive.

1—254 CFM Chicago Pneumatic NSB-125# Belt Drive 40 H.P.

2—245 CFM Ing. Rand 10x10 ER-1, 125#.

1—215 CFM Penna. 3A 10x8, 50 lb.

2—175 CFM Ingersoll ER-1 9x8, 300 RPM, 100 LB., V-belt.

CENTRIFUGAL PUMPS

Q	GPM	TNH	Description	Size	HP	Speed
2	10,000	200'	LeCourtenay	20"	624	870
2	10,000	100'	LeCourtenay	20"	350	870
1	10,000	114'	De Laval	18"	370	988
1	9,000	88'	De Laval	18"	250	870
2	8,150	132'	LeCourtenay	16"	350	1150
1	8,000	110'	Worthington	14"	500	1200
2	7,000	200'	LeCourtenay	16"	423	1000
2	6,500	100'	Worthington	14"	200	1200
1	6,000	110'	Ingersoll-Rand	12"	500	1200
2	5,000	125'	Worthington	14"	200	1200
1	4,000	110'	Ingersoll-Rand	12"	500	1200
1	3,500	47'	Southwark	12"	75	870
1	3,100	42'	Worthington	12"	50	1150
2	2,550	200'	De Laval	8"	200	1750
1	2,310	24'	Worthington	12"	20	860
2	1,700	95'	De Laval	10"	60	1750
1	1,500	231'	Allis-Chalmers	8"	150	1750
3	1,200	40'	Worthington	6"	15	1750

TURBO GENERATORS

1—750 KVA G.E. Extraction 3/60/2300 volt, 250 PIS, 80 lb. & 16 lb. Extr. Surface Condenser. New 1940.

1—625 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Condensing 180 PSI 35 lb. B.P. New 1936.

1—500 KVA West. Non-Cond. 3/60/220/440, 150 PSI 10 lb. B.P.

3—300 KW West. 3 wire 125/250 Volt D.C., Non. Cond. Turbo Units 125 PSI, 5 lb. B.P. New 1938—(See Actual Photo.)

1—75 KW G.E. Non-Cond. D.C. 125 volt.

1—35 KW G.E. Non-Cond. D.C. 125 volt.

3—300 KW D.C. TURBOS—125/250 Volt

"Everything from a Pulley to a Powerhouse"

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ELECTRICAL EQUIPMENT

Electrical Equipment—Rebuilt and Guaranteed—Motors—Generators—M-G Sets—Transformers—Controls

REBUILT AND GUARANTEED

PROMPT SHIPMENT — PARTIAL LISTING

800/1600 AMPERE ARC WELDING MOTOR GENERATOR SETS

Each set consists of two generators and one motor, mounted on base. Each Generator: Northwestern Type K200R, 800 ampere, 50 volts, 1750 RPM. Motor: 125 HP, Allis Chalmers, Type AR, 2200 volts, 3 phase, 60 cycle, 1750 RPM.

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
6	7½	870	550	G.E.	MTC-3201
3	10	1140	440	West.	HF-7A
2	10	570	220	G.E.	H1-11
2	111	870	550	G.E.	ITC-3003
2	15	1160	440	West.	CW4644C
2	15	570	220	West.	CW-646
1	18	680	440	West.	MW-316
1	20	860	440	West.	CW-658
1	25	1150	550	G.E.	MT-323
2	25	350	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	865	440	West.	CW-646
1	30	350	440	G.E.	MT-332
1	30	675	440	G.E.	MT-326
2	30	600	440	F-M	HV-H16A
2	40	865	2200	Al. Ch.	ARY-222C
1	40	560	440	G.E.	MT-349
2	50	1150	440	G.E.	M-536
1	50	860	440	West.	HF-12A
1	50	570	440	G.E.	MT-552
5	52½	550	220	G.E.	IQC-5013***
1	60	685	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW-938
1	801	575	440	G.E.	MTC-5352
1	125	430	440	G.E.	IL-18
2	150	1750	440	G.E.	MTP-549
1	175	595	550	West.	CW-1002
1	200	485	2200	G.E.	IM-17A
1	250	600	2200†	G.E.	IM-17
3	300	900	110	G.E.	IM-17
3	300	885	2200	G.E.	IM-17A
2	350	1775	2300	G.E.	IM-815A
2	350	880	2300	G.E.	IM-17A
1	400	595	550	West.	CW
1	600	1770	440	G.E.	IM-E15C
1	700	1735	4000‡‡	West.	CW

220 volt motors can be reconnected for 440 volts. ‡Intermittent rating. ***2 phase. **New. 1125 cycle. *Also 410 or 2300 volts. †Also 440 or 550 volts.

A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Winding & Direct Connected Exciter.

Qn	KVA	RPM	Make	Volts
3	18.7	1800	Columbia	240/120
4	18.7	1800	Columbia	208/120

230 VOLT CONST. SPEED D.C. MOTORS

Qn.	Hp.	Speed	Make	Type
10	¼	850	Reliance	Y-22T
25	⅜	850	West.	SK-20
1	¾	1150	G.E.	CDM-66
3	¾	850	G.E.	CD-75
10	10**	1750	Kimble	BA-324
5	10**	1150	Al. Ch.	ED-80
2	10	850	West.	SK-83
10	12½**	900	West.	SK-94
3	15	1750	G.E.	CD-75
5	15	825	West.	SK-90
1	20	1750	L.A.	ONA-L651
1	20**	1450	G.E.	CDM-85
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	BC-30
1	20**	1450	G.E.	CDM-38
11	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	1100	G.E.	BC-12
1	40	1700	West.	SK-106J
1	40	750	G.E.	BC-34
1	50	750	West.	SK-150
1	50	650	G.E.	BC-16
1	150	700	Al. Ch.	
2	200	1150	G.E.	BC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D.C. MOTORS

Qn.	Hp.	Speed	Speed	Type
6	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
1	12½	230/310	West.	SK-130
10	13½**	880	West.	SK-93
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20/25	100/1200	West.	SK-153
1	25	400/1600	G.E.	RF-13
1	25	500/1500	G.E.	RF-12
1	30/39	300/1200	G.E.	RF-15
1	30	400/1200	West.	SK-163
1	30/40**	400/1600	G.E.	CD-1236
1	35	500/1500	West.	SK-143
1	75	500/1500	Cr. Wh.	CUM
1	75	375/750	Cr. Wh.	
5	100	225/900	G.E.	MPC 125M
5	100	400/1200	Al. Ch.	
1	100	230/900	West.	SK-200
1	125	450/1600	West.	SK-190
1	175	220/500	West.	SK-220
2	375	250	G.E.	MPC

Above Items Represent a Partial Listing Only. Your Equipment is Located in Our Cleveland Warehouse.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Totally Enclosed Fan Cooled, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
2	5	1160	440	L.A.	JS-254
8	5	1730	440	G.E.	K-254
1	7.5	1740	440	G.E.	K-284
1	10	1725	440	West.	CS-324
2	10	1165	440	West.	CS-326-EXP
1	10	1140	440	Wagner	CP2-326
1	15	1175	440	L.A.	JA-365
1	20	1760	220	G.E.	K-364
1	25	1200	550	G.E.	K-403
1	25	1170	220	L.A.	JX-405
1	25	703	440	West.	CS-W504
1	60	3565	440	G.E.	KF-4038

SPLASHPROOF, BALL BEARING

Qn.	HP	RPM	Volts	Make	Type
1	3	1160	440	L.A.	PS-254
23	5	1730	440	L.A.	PS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	PX-284
4	15	1150	440	L.A.	PX-365
1	30	1760	440	L.A.	PX-445A
5	50	1160	220	G.E.	K-504
1	150	1775	440	L.A.	PX-1168
1	150	880	440	L.A.	PX-1268
1	150	700	440	G.E.	KF-6335

OPEN TYPE MOTORS

Qu.	HP	Speed	Volts	Make	Type
1	15	3485	220	Reliance	AA-B3247
5	15**	1735	440	Century	SC326
1	15	1200	220	G.E.	KT-562
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RPI-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KF-512
2	20	1160	440	West.	CS-464C
2	20	900	220	G.E.	FTR-522
1	25	1800	220	G.E.	KT-513
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-467C
1	25	900	220	Howell	SCRB-356***
1	25**	875	440	Master	PB-405
2	25	575	440	G.E.	KT-542
3	30	3550	550	G.E.	K-3648
1	30	1735	220	G.E.	PT-513
1	30	1160	440	West.	CS644
1	30	870	220	West.	CS646
1	40**	3545	220	G.E.	KF-4048
2	40	1750	440	West.	CS-580C
2	40	900	2300	G.E.	FTR-536
1	50**	1750	440	Wagner	RP5-405
1	50	850	220	West.	CCL
2	60*	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-546
1	75	1160	440	West.	CS-662C
4	75	870	220	West.	CS-760A
2	75	865	2200	G.E.	KT-552
1	100	690	220	West.	C
1	100	580	2200	G.E.	IK-15A
2	100	500	2200	West.	CS-930
1	100	495	2200	Al.Ch.	AN
1	125	435	440	Al.Ch.	AB
2	125	400	2300	G.E.	I-17-FR
1	200	580	550‡	G.E.	KT-566S
3	300	587	2200	West.	CS-39A
1	500	1200	110	G.E.	KTP-567
1	700	1800	2300/ 4000	West.	CS-4-39D12

220 volt motors can be reconnected for 440 volts. **New. ***2 Phase. ‡‡Reconnectable for 440 volts.

G. E. DYNAMOMETER

Cradle Type, with control and Dial Scale. (Write for Complete Specifications.)

Qn.	HP	DC Volts	RPM	Type
1	200	250	1200	C

MOTOR GENERATOR SETS

125 and 250 Volts D.C.

(Write for complete Specifications)

KW	Make	RPM	DC Volts	AC Volts
2	Cont.	1750	125	220/440
7.5	West.	1455	125	380/220‡
10	West.	1750	125	220/440
10	West.	1450	125	220/440†
10	West.	1150	250	220/440
15**	G.E.	1800	125	220/440
15	G.E.	1755	250	220/440
15	West.	1450	125	220/440‡
16	West.	1750	125	2200/440
25	G.E.	1700	125	220/440
30	Al. Ch.	1750	125	220/440
50	G.E.	1720	125	220/240†
75	G.E.*	1200	125	220/240

Note: 3KW, 5KW & 7.5KW, 250V Sets Available. **New. *Synch. Motor Driven. ‡50 Cy. 575 Cy. Inquiries Will Receive Our Prompt Attention. All We have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVENUE • CLEVELAND 14, OHIO

Motors—Generators—M-G Sets—Transformers—Controls—Electrical Equipment—Rebuilt and Guaranteed

TRANSFORMERS

FOR SALE

1 Phase, 60 Cycle

3—400 KVA W-H 13200—600/575/550
3—333 KVA G-E 33000—2300/4000Y
3—250 KVA W-H 13800—2300
3—250 KVA Kuhl 6600—575
3—200 KVA G-E 13200—120/240
3—100 KVA G-E 33000—6900/11950Y
3— 75 KVA G-E 11500—230/460
3— 50 KVA G-E 33000—2400/4160Y
3— 50 KVA A-Ch 33000—2400/4160Y

3-Phase, 60 Cycle

3— 750 KVA W-H 13800—460 Dry Type
1—4000 KVA W-H 15000/12750 Auto

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
CINCINNATI 27, OHIO

CASH

FOR

TRANSFORMERS
MOTORS

See Our Ad, Page 308

ELECTRIC EQUIPMENT COMPANY
63 CURLEW ST., ROCHESTER 1, N. Y.
Glenwood 6783 LD-65

FOR SALE

MODERN 1000 KW Turbo-Generator

In Excellent Condition

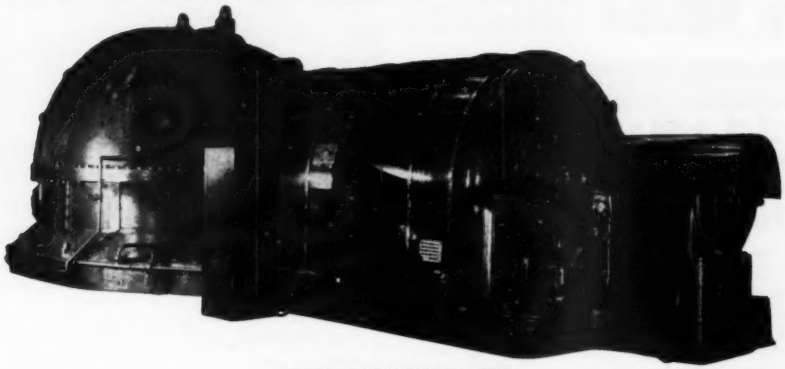
Non-Condensing, Steel case 80# back pressure .3 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, all circuit breaker, and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

NEWMAN & COMPANY, INC.
6101 Tacony St. Philadelphia 24, Pa.

FOR SALE
DIESEL ENGINES
GM 6-71 Quads
GENERATOR SETS
60KW — AC 440v
with Diesel Engines

DULIEN STEEL PRODUCTS, INC.
of Washington
9265 E. Marginal Way
Seattle 8, Washington

25,000 KVA—20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company condensing turbine generator unit 215 P.S.I.G. 540-550° total temperature complete with direct connected shaft exciter, switchboard and instruments, a 30,000 square foot 2-pass Westinghouse surface condenser, motor driven and turbine driven pumps and condensing accessories.



ACTUAL PHOTOGRAPHIC VIEW

EXCELLENT CONDITION — COMPLETE INSTALLATION — PROMPT DELIVERY

TURBINE-GENERATOR UNITS

Condensing—3 phase, 60 cycle

6250 KVA G.E., 3-stage, 2300/4000 volts, 200# P.S.I., 600° TT.

4000 KVA Allis, 2300 volts, 150-200 PSI.

3750 KVA Allis, 2300 volts, 125-175 PSI.

2500 KVA G.E. Type ATB, Form HT, 2300/480 volts, 3600 RPM, 2-bearing alternating current generator LESS TURBINE.

2500 KVA G.E. 600 volts, 200 PSI.

1875 KVA Westghse. 2300 volts, 250 PSI.

1563 KVA Allis, 600 volts, 200 PSI.

1250 KVA G.E. AUTOMATIC EXTRACTION BLEEDER 2300 volts, 250 PSI.

780 KVA Allis, 480 volts, 150 PSI.

625 KVA G.E. 480 volts, 150 PSI with surface condenser.

Non-condensing—3 phase, 60 cycle

940 KVA Allis 2300/480 volts, 125-150 PSI 12# back.

625 KVA G.E. 480 volts, 125-150 PSI, 20# back.

375 KVA Westghse-Moore 480 volts, 250 PSI 5-10# back.

300 KVA Allis 125 PSI, 10# back.

125 KVA G.E., 2300 volts, 150-200 PSI, 10# back.

125 KVA Westghse. 2400 volts, 150-250 PSI 10# back.

Direct Current

500 KW G.E., 250 volt, 200 P.S.I., 25# gauge back non-condensing.

300 KW Westghse. 3-wire, 250 volt 150/250# P.S.I. non-condensing.

100 KW (2) G.E., 125 volts, 200-275 PSI.

75 KW (2) Westinghouse-Moore, 120 volt, 200# P.S.I. condensing.

60 KW (2) Elliott, 125 volt, 200-250 P.S.I. non-condensing.

MOTOR GENERATOR SETS

100 KVA Westghse. 60 cycle, 2400 volts, 900 RPM alternator direct connected 135 HP, 250 volt direct current motor.

62½ KVA G.E., 60 cycle, 2300 volt alternator to 75 HP, 125 volt DC motor.

50 KW G.E. 125 volt direct current 1200 RPM to a 3 phase, 60 cycle, 220 volt syn. motor.

10 KW G.E. 125 volts direct current to 12 HP 60 cycle, 220 volt motor.

OCTOBER BARGAINS SPECIALLY PRICED

2—Elliott twin oil strainers connected to a 25 HP, 3 phase, 60 cycle, 220 volt G.E. totally enclosed motor, practically new.

1—200 HP and 1—150 HP G.E., 60 cycle, 440 volt, 1800 RPM motors.

1—4400 sq. ft. Worthington surface condenser.

2—1000 GPM, 1270 foot head, 4-stage Morris pumps each connected 417 HP, 390# P.S.I. non-cond. G.E. turbine.

1—G.E. Bank of Scott connected 2 to 3 phase, 60 cycle transformers, 2500 KVA capacity.

SYNCHRONOUS MOTORS

3 phase, 60 cycle

5000 KVA Westinghouse, 4000 volt, 720 RPM Electrical Syn. (condenser).

900 HP Allis, 2200 volts, 150 RPM.

UNAFLOW GENERATOR UNITS

Alternating Current—3 phase, 60 cycle

600 KVA G.E. 2300/480 volts, 450 RPM generator connected Fairbanks Morse DIESEL engine.

500 KVA G.E., 2400/480/240 volts generator connected Ames Vertical Engine, 150 PSI—5# back.

375 KVA G.E., 2300/440 volts generator connected 23"x24" Skinner Horizontal engine, 125-150 PSI.

175 KVA Westghse., 240 volt generator connected Skinner Horizontal Engine, 125-150# P.S.I., 5# gauge back.

Direct Current

400 KW G.E., 3-wire, 250 volts, 360 RPM generator connected Skinner vertical engine 150 PSI—5# back.

250 KW Crocker Wheeler 125 volt generator direct connected Ames Vertical non-condensing engine 150#.

25 KW (2) Allis 250 volt, 500 RPM generators each direct connected American Blower vertical engine.

20 KW Louis Allis 125 volt generator connected Hill vertical Diesel engine MODERN.

UMC UTILITIES MACHINERY CORP.

1965 EAST 6th STREET • CLEVELAND 14, OHIO • Long Distance 422

There's more than 40% to 60% SAVINGS on

SCHOONMAKER DEPENDABLE DIESEL POWER

because:

Each Schoonmaker-sold Diesel Engine Unit is fully REMANUFACTURED in our plants by highly skilled, factory-trained Diesel engineers. Only genuine factory-made and approved parts are used and all REMANUFACTURING is in strict accordance with manufacturer's recommended procedures. Prior to shipment every engine is subjected to a FULL LOAD operating test in accordance with DEMA standards.

The Schoonmaker Plants and Warehouses located in Jersey City, N. J. and Sausalito (San Francisco), California give NATIONWIDE SERVICE from Coast to Coast with modern, efficient and reliable facilities.

Our reputation and many years of experience and SPECIALIZATION in Diesel power equipment gives you value that money cannot buy elsewhere.

So—Buy SCHOONMAKER because you buy the FINEST in DEPENDABLE DIESEL POWER.

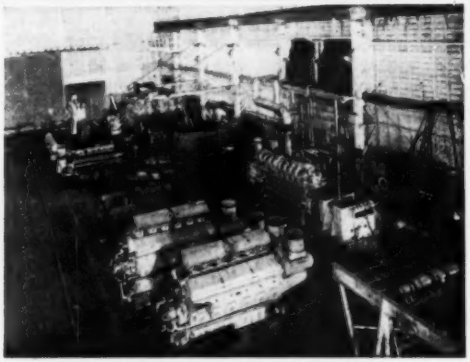
A.G.

SCHOONMAKER CO., INC.

52 CHURCH ST., NEW YORK 7, N. Y.

PLANTS AND WAREHOUSES:

JERSEY CITY, N. J. AND SAUSALITO (S.F.), CALIFORNIA



PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT.

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1500	Fairbanks Morse	33E16	2000	300
1230	Nordberg	F6G168SC	1750	327
1136	Fairbanks Morse	38D	1600	720
1000	General Motors	16-278A	1600	720
750	General Motors	12-567	1080	720
500	Alco	6-12-1/2x13T	750	600
500	Worthington	EE	750	327
500	General Motors	8-567	720	720
340	Baldwin	VO-6	510	450
320	Buckeye	80	480	600
300	Enterprise	DSG-6	450	450
300	General Motors	8-268A	450	1200
264	Superior	KNA	396	514
167	Ingersoll-Rand	S	255	600
160	Buckeye	80	240	600
100	General Motors	3-268A	150	1200
100	Worthington	88-5	150	600
60	General Motors	6-71	90	1200
50	Caterpillar	D-8800	76	1200

ALTERNATING AND DIRECT CURRENT UNITS STANDARD AND SPECIAL VOLTAGES AS REQUIRED

ONE YEAR GUARANTEE!

Most all units still on foundation. Many may be seen operating

TURBO GENERATOR UNITS

2820 KVA GE 2300 V. Non-Cond.
3750 KVA Wghse. 600 V. Bleeder
1250 KVA GE 480/240 V. Bleeder
937 KVA Wghse. 480/240 V. Bleeder
750 KVA Al. Chal. 480/240 V. Cond.
375 KVA Wghse. 240/480 V. Cond.
375 KVA (2) Al. Chal.—Elliott Non-Cond.
250 KVA GE Non-Cond. 2300/600 V.
187 KVA GE 480/240 V. 370# & 65/165# exhaust
125 KVA GE 240/480 V. Non-Cond.
62 KVA NW. 480/240 V. Non-Cond. 310#
62 KVA NW. 240/480 V.—DeLaval

ENGINE-GENERATOR UNITS

450 KVA GE 2300 V.—Ames Uniflow
312 KVA GE 480/240 V.—Skinner Unif.
250 KVA (3) EM. 240/480 V.—Skinner Unif.
187 KVA Wghse. 240/480 V.—Ames. Unif. 3 Cyl. (vertical)
62 KVA GE 240/480 V.—Ames Unif.

DIESEL UNITS

1000 KVA Elliott-DeLaverne
600 KVA Elliott-Booker Bessemer
438 KVA (2) GE-General Motors
375 KVA Fairbanks Morse 32E-14
353 KVA (2) Fairbanks Morse 32-D
250 KVA GE-Buckeye-E
250 KVA Fairbanks Morse 32E-14
200 KVA Fairbanks Morse 32E-14
187 KVA EM.-Buckeye-E
175 KVA Fairbanks Morse 32E-14
160 KVA Wghse.-Buda (Package)
125 KVA GE-Worthington
100 KVA Fairbanks Morse 32E-14
90 KVA (2) Fairbanks Morse 32E-14
75 KVA General Motors (Package)
50 KVA (2) Fairbanks Morse 42F

BOILERS

400 HP Combustion 3 Dr. 160#
427 HP Bigelow 3 dr. 200#
400 HP (2) Wicks 3 Dr. Low Hd. 160#
316 HP Wicks 3 Dr. Low Hd. 160#
360 HP (3) Walsh Widener sec. hdr. 330#
333 HP Bigelow 3 Dr. 250#
300 HP Combustion 3 Dr. 160#
261 HP Farrar, Firebox 125#
220 HP (2) Vogt 3 dr. Low Hd. 160#
175 HP Keeler Firebox 125#
151 HP (3) Murray, Low Level 250#
150 HP Farrar Firebox 150#
125 HP (2) Erie City Firebox 150#
250 HP (3) Coatesville HRT 150#

Above listed units are only a few of our "SPECIALS." Advise your plant requirements.

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt St.
New York, N. Y.

ELECTRIC MOTORS AND GENERATORS

WAGNER CERTIFIED REBUILT

BACKED BY 45 YEARS OF QUALITY AND SERVICE

For QUALITY • SERVICE • PRICE - "Check with WAGNER First!"

OVER 45 YEARS OF EXPERIENCE is back of every machine sold by Arthur Wagner Company. Large stocks and modern facilities insure ample choice and prompt service at reasonable cost. All Wagner "Certified Rebuilt" equipment conforms to standards approved by National Industrial Service Association. Inspect our shop and stock—see why it pays to . . . "Check with Wagner First!"

M-G SETS

KW	Mfr	Input V	Output V
300	Allis Ch.	2200/440 AC	125/250 DC
300	G.E.*	440 AC	275 DC
200	Whse.*	2300 AC	275 DC
200	Gen. Elec.*	220/440 AC	125 DC
150	Gen. Elec.*	2300/440 AC	600 DC
150	Whse.*	220/440 AC	125/250 DC
105	Century b.b.	220/440 AC	70 DC
100	Allis Ch.* (2)	230 DC	220 AC
100	Whse.	2200/440 AC	60 DC
100	Whse.*	220/440 AC	250 DC
100	Gen. Elec.	2200/440 AC	125 DC
100	Gen. Elec.	220/440 AC	250 DC
75	Gen. Elec. (2)	220/440 AC	250 DC
75	Gen. Elec. (3)	220/440 AC	125 DC
65	Whse.	220/440 AC	250 DC
60	Gen. Elec.*	220/440 AC	60 DC
50	Allis Ch. (2)	220/440 AC	125/250 DC
50	Gen. Elec.	220/440 AC	250 DC
45	Cr. Wh. b.b.	20/440 AC	125 DC
40	Gen. Elec.	220/440 AC	550 DC
40	Whse. (2)	220/440 AC	125 DC
40	G.E.	220/440 AC	250 DC
35	Cr. Wh. b.b.	220/440 AC	125 DC
25	G.E.	220/440 AC	48 DC
25	Gen. Elec.	220/440 AC	250 DC
25	G.E. b.b. New	220/440 AC	125 DC

*Syn. motor drive.

D.C. MOTORS

HP	Mfr	Type	Volts	Speed
200	Gen. Elec.	CD188A	230	400/1200
150	Whse. dynamometer		250	3000/5000
150	Cr. Wh. TEFC	83H	230	900
100	Whse.	SK181	230	450/900
100	Gen. Elec.	C	230	575/1000
100	Gen. Elec.	CD125	230	850
75	Whse (2)	SK163	230	850
75	Gen. Elec.	BC	230	1000
75	Northw'n	K20	230	1750
60	Cr. Wh.	50H	230	700
60	Reliance b.b.	651T	230	750
50	Gen. Elec.	LC	115	400/800
50	Cr. Wheeler	CMC	230	1750
50	Gen. Elec.	R.C. 14	250	1050
50	Century New	R91	230	690/1150
40	Gen. Elec.	RC32	550	1200
40	Gen. Elec.	RC-32	230	1150
40	Cr. Wheeler	EH	230	1750
40	Whse.	SK110L	230	1750
40	Whse (2)	SK130	230	950
35/50	Gen. Elec.	CD123	230	575/1150
30	Whse.	SK110L	230	1150
30	Whse. (2)	SK90	230	1700
25	Gen. Elec.	CD85	230	750
25	Whse.	SK150	230	300/1200
25	G.E. (2)	CD93	230	1150
25	G.E. b.b. New	CDM93	115	1150
25	Gen. Elec.	RF13	230	250/1000
25	Gen. Elec.	CD105	230	500/1500
20	Gen. Elec. (2)	CD83	230	1750
20	Gen. Elec.	RF12	230	400/1800

- EXPLOSION PROOF MOTORS—
- GEARHEAD MOTORS, AC & DC.
- FREQUENCY CHANGERS.
- CIRCUIT BREAKERS, AC & DC.
- SPEED-REDUCERS.

D. C. GENERATORS

KW	Mfr	Type	Volts	Speed
300	Allis Ch. New	MECW	125/250	1200
300	Gen. Elec. 1 brg.	DMC	275	720
150	Cr. Wh. b.b.	83H	230	1150
150	Whse.	SK191	125/250	900
105	Century b.b.	1500 amp	70	1200
100	Gen. Elec.	CD	250	1200
100	Gen. Elec.	C	250	750
75	Gen. Elec.	BC	250	1200
75	Gen. Elec.	RC38	125	1200
65	Whse.	SK160	250	1100
60	Gen. Elec.	LC	250	700
50	Allis Ch. (2)	EW	125/250	1200
50	Gen. Elec.	R.C. 14	250	1200
50	Cr. Wheeler	50H	250	900
45	Cr. Wh. b.b.	FH	125	1750
40	Whse.	SK	250	1200
40	Gen. Elec.	RC32	250	1500
40	Gen. Elec.	RC32	550	1500
25	Gen. Elec.	CD	250	1500
25	G.E. b.b. New	CDM93	125	1450

A. C. GENERATORS — 60 CYCLE

KVA	Mfr	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	2300	750
500	Allis Ch.	3 brg	240/480	360
500	Gen. Elec.	ATB	240/480	900
300	Gen. Elec.	ATB	600	720
275	G.E. 25 cycle	ATI	480	750
250	Whse.	G	2400/480	600
225	Gen. Elec.	ATB	240/480	600
200	El. Machy.		2300	900
125	Gen. Elec.	ATB	240/480	720
125	Gen. Elec.	ATB	240/480	300
99	Gen. Elec.	ATI	240/480	1200
75	El. Machy.		2300	900
75	Gen. Elec.	ATI	240/480	1200
56	Gen. Elec.	ATB	240/480	1200
56	Gen. Elec.	ATB	240/480	900
31	Whse. b.b.	late	120/208	1200

A. C. MOTORS — SLIP RING
3 Phase 60 Cycle 220 or 440 Volts

QU	HP	Mfr	Type	Speed
1—	600	Gen. Elec.	IM	360
1—	500	G.E. 3 brg.	I-M	450
1—	400	Gen. Elec.	I-M	514
1—	350	Whse. 2200V.	CW	450
1—	300	G.E. 2300V	I-M	1800
1—	300	Whse. 2200V.	CW	600
1—	300	Gen. Elec.	I-M	720

1—	250	G.E. 2200V.	IM-17A	600
1—	250	Allis Ch. 2200V.	ANY	514
1—	250	Cr. Wheeler	SR	600
1—	200	Whse	CW874C	900
1—	200	Cr. Wheeler	SR	600
1—	200	Gen. Elec.	I-M	360
2—	200	Gen. Elec.	I-M	600
1—	150	G.E. 2200/4400V. Vert.	I-M	1200
1—	150	Gen. Elec.	I-M-17	450
1—	150	G.E.	IM-16	600
1—	100	Gen. Elec.	I-M	720
2—	100	G.E. New	M-6324	1200
2—	100	Gen. Elec.	I-M	1800
1—	100	G.E. Vertical	MT553	1200
1—	100	Cr. Wheeler	SR	600
1—	100	Northwestern	HW	1800
2—	75	Gen. Elec.	MT552	900
1—	75	Whse. 2200V.	CW	900
2—	75	Gen. Elec.	MT343	1800
1—	60	G.E. TEFC b.b.	M-6328	720
1—	60	Fair. Morse	BV	720
1—	60	Whse. 2200V.	CW716C	900
1—	60	Gen. Elec.	MT343	1200
1—	50	Allis Ch.	ANY	900
1—	50	Howell	SR437	1200
1—	50	Gen. Elec. int.	ITC5013	600
2—	40	Whse.	CW636A	1200
2—	38	G.E. 2200V.	MT332	900
1—	30	Gen. Elec.	MT332	1200
2—	30	Gen. Elec.	MT332	900
2—	25	Gen. Elec.	MT	900
3—	25	Gen. Elec. int.	MTC5528	720
3—	20	Whse. b.b. New	CW384	1800

A. C. MOTORS — SYNCHRONOUS

HP	Mfr	Type	Volts	Speed
600	Gen. Elec.	TS	2200	514
500	Gen. Elec.	ATI	220/440	900
300	Gen. Elec.	ATI	2300/550	450
300	Whse.	G	2200/440	600
300	Gen. Elec.	ATI	440	720
275	G.E. 25 cycle		220/440	750
220	G.E. 3 brg. .8 PF	ATI	220/440	600
250	Gen. Elec.	TS	220/440	360
200	El. Machy.	SPF	2300	900
200	G.E.	TS	220/440	150
190	El. Machy.	3 brg.	220/440	514
175	Whse.	2 brg.	220/440	360
150	Gen. Elec.	ATI	220/440	720
150	Gen. Elec.	ATI	220/440	800
125	El. Machy. (2)		220/440	1800
120	Burke b.b. .8PF	AC19	2200/440	1200
125	El. Machy.	B.B.	2400/4800	900
100	American b.b.	YGH	220/440	900
90	Gen. Elec.	TS	220/440	1200

A. C. MOTORS — SQUIRREL CAGE
3 Phase 60 Cycle 220 or 440 Volts

QU	HP	Mfr	Type	Speed
1—	500	Fair. Morse 2200V.	BH	1200
1—	500	G.E. 2200V.	KTP561	1800
1—	300	Gen. Elec.	I-K	600
2—	250	Whse. 2200V.	CS	1200
1—	250	Gen. Elec.	FT549AZ	8600
1—	250	Gen. Elec.	IK-17A	450
1—	250	Gen. Elec.	IK-17	600
1—	250	Gen. Elec.	I-K	720
1—	200	Gen. Elec.	IK-17	514
2—	200	Reliance b.b. New	B60858	1800
2—	200	Gen. Elec.	I-K	600
1—	200	G.E. 3 brg.	I-K	600
1—	200	Gen. Elec.	KT568	600
1—	200	U.S. b.b. New	SC587	1200
2—	150	Gen. Elec. 2200V.	IK-15A	720
1—	150	Gen. Elec.	IK-16	600
1—	150	U.S. b.b.	SA	900
1—	150	Ideal 2200V.	A-327	1800
1—	150	Gen. Elec. TEFC b.b.	K6333S	1200
1—	150	Gen. Elec.	IK-17	450
1—	150	G.E. TEFC	K6326	3600
1—	150	Whse.	CS	720
1—	150	Al. Ch. 2200V. b.b.	ARX-926	900
2—	125	Rel. TEFC New	B6085S	1800
2—	125	Gen. Elec.	K-558	900
1—	125	G.E. b.b. New	K6326S	1200
1—	125	G.E. New b.b. HT	K06324	1200
1—	125	Con. 2200V. b.b.	SC	1800
2—	125	G.E. 2200V. TEFC	K6326	3600
2—	100	Reliance b.b. New	5058	1800
1—	100	Gen. Elec.	KT356	900
1—	100	Gen. Elec.	I-K	1200
2—	100	Gen. Elec.	CS	720
2—	100	Whse.	5058	3600
1—	100	Rel. TEFC New	5048	3600
1—	75	Rel. TEFC New	I-K	3600
1—	75/90	Gen. Elec.	IK-15	600
2—	75	Whse.	CS	720
1—	15	Fair. Morse b.b.	HJQ	600
1—	75	Reliance b.b. NEW	C5084	900
2—	75	Reliance b.b. NEW	C505	1800
1—	75	G.E. TEFC 2200V.	K-6325	900
2—	75	Gen. Elec.	KT343	1200
2—	75	Gen. Elec.	I-K-14	600
1—	75	G.E. Expl. Pf. 2200V.	K6325	1200
2—	60	Gen. Elec.	KT546	900
2—	60	Howell b.b.	K504	1200
1—	60	Gen. Elec.	KT556	450
1—	60	Reliance b.b. New	CC505	900
2—	60	G.E. Vertical	KT538	1200
2—	60	Gen. Elec.	I-K	600
2—	60	G.E. 2200V.	KT533	1800
2—	60	Reliance b.b. NEW	B504	1800
1—	60	Reliance TEFC NEW	C505	1200
2—	50	Gen. Elec.	KT346	720
2—	50	G.E. Vertical	KT546	720
2—	50	Reliance b.b. New	CC504U	900
2—	50	Whse.	CS	1200
2—	50	Reliance b.b. NEW	C445	1200
2—	50	Howell TEFC	K445	1800
1—	50	Whse. histip	WL607	900
2—	50	Fair. Morse b.b.	HJ-12D	900
2—	50	Gen. Elec.	KT527	1800
1—	40	Louis Allis b.b.	OX404	3600
2—	40	Gen. Elec.	KT532	1200
1—	40	Gen. Elec.	KT336	900
2—	40	Gen. Elec.	KT346	600
2—	40	Whse. b.b.	CS-504	1200/900
2—	40	Reliance b.b. New	CB404	1800

A. C. MOTORS — 25 CYCLE

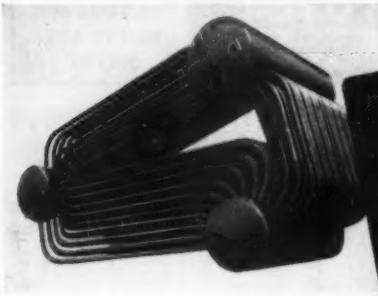
HP	Mfr	Type	Volts	Speed
275	G.E. synch.	ATI	440	750
150	Whse.	HF	440	300
60	Allis Ch.	ARY	440	1500
50	Gen. Elec. int.	MTC5337	440	750
50	Gen. Elec.	I-K	440	750
30	Gen. Elec.	MT343	440	750
25	Howell	SR	440	750

CERTIFIED

Arthur Wagner Co.

1433 W. RANDOLPH ST. MOnroe 6-7409 CHICAGO 7, ILLINOIS

QUICK SHIPMENT FROM STOCK—
LOW PRICES — FULL GUARANTEE
Send for Complete Stock Lists



STANDARD 3-DRUM LOW HEAD WATER-TUBE BOILER DRUMS WITH TUBES.

BOILERS READY TO SHIP!!

HERE ARE 4 OUT-STANDING VALUES IN GOOD USED 3-DRUM LOW-HEAD BOILER PLANTS!

TUBES NOW ASSEMBLED IN BOILER DRUMS. CAN BE SHIPPED IN ONE PIECE (SUBJECT TO R.R. CLEARANCE)

1 **SPECIAL VALUE AND PRICE!** 1—20,000 lb. steam/hr. ERIE CITY 3-drum low - head Water Tube; 160 lb. pr. LIKE NEW. INSTALLED 1947—USED LESS THAN 3 MOS. Incl. Peabody Oil Burners w/pre - heaters; Soot Blowers; Breeching; Blower; Pumps; Preheaters; Feedwater Pump; Condensate Receiver; Sup. Steel; Stack. ASME, Nat'l Board. Everything NEW when installed. A COMPLETE PLANT. Offering less than ½ replacement cost. Located Brooklyn. Ask for No. 1001.

2 1—301 H.P. TITUSVILLE 3 - drum low - head watertube; 200 lb. pr.; good for 20800 lb. steam pr/hr. @ 200% of rating. Model A-3-15. 3016 sq. ft. H.S.; all Trim; Vulcan Soot Blowers; Soot Hoppers; Clean-out & Explosion Doors; Sup. Steel; Damper and Damper Box; Buck Stays; Tie Rods. Floor line to top Steam Outlet 23 ft. Boiler built 1941. Reconditioned with new Mfg. Data Sheet. EXCELLENT CONDITION. Located N.W. Penn. Ask for No. 1002.

3 1—312 H.P. FOSTER WHEELER 3-drum low head Boiler. 160 lb. Pr. with Detroit Single Retort Stoker. About 10 yrs. old but good condition. Incl. all trimmings and sup. steel. An excellent "buy"—well worth an inspection. Ask for specs. and prints—No. 1003.

4 1 or 2—250 H.P. ERIE CITY 3-drum low-head watertube; 200 lb. pr. Soot Blowers; Peabody Mech. Atom. Oil Burners; Steam and Elec. Pre-Heaters and integral Pump Sets; Feed Water Regulators; Feed. Water Heaters; Warren Duplex Pumps; Catwalks; Ladders; Piping; Thermix Stacks. Built 1940 but all Boiler tubes were removed and replaced in 1946. Shut down in 1950. Sup. Steel; all trim. A FINE COMPLETE PLANT. Loc. Massachusetts. Ask for No. 1004.

Complete specifications and drawings furnished upon request.

ASK FOR OUR LATE USED BOILER LIST SHOWING ALL BOILER TYPES FROM 10 H.P. to 1000 H.P.

J. PARKER THOMPSON CO. Inc.

507 5th AVE. NEW YORK, N.Y.
MURRAY HILL 7-6547

Make a friendly connection, Call Sandman for stock deliveries. Partial Inventory of Rebuilt Guaranteed 3-60-220 & 440 V motors.

SQUIRREL CAGE

HP	RPM	Make	Remarks
100	720	G.E.	I-K
50	1800	Reliance	NEW BB
40	1800	Al-Ch	200
35	1200	G.E.	I-K
30	3600	F-M	HB
30	1200	C-W	BAH-405 BB
30	600	G.E.	I-K
25	1800	G.E.	KT-312
25	1200	Cent.	SC30
25	1200	West.	CS
20	3600	G.E.	KT203
20	1800	G.E.	FT501
20	1200	G.E.	KT312 BB
20	1200	G.E.	I-K 2 Shaft
20	900	Wagner	18VBP
20(4)	600	G.E.	PT 506 TEBB
15	900	R & M	L-440
15	514	G.E.	KT552
10	1200	G.E.	I-K

WOUND ROTOR

HP	RPM	Make	Remarks
100	900	G.E.	MT556
50	900	G.E.	I-M
40	720	G.E.	MR-504 Hoist
25	900	West.	C1572A Hoist
15	1200	Wagner	15VRS
7½	1200	West.	CW452
7½(2)	800	G.E.	MT959
5	1200	Watson	KHTV
5(2)	900	G.E. & West.	MT & CW
3	1200	Cleve.	MBW2375
3	900	G.E.	MT944
2(2)	1200	G.E. & West.	MT & CW
1½(4)	1200	G.E.	MT & CW

Also some 550 V & 2200 V ratings.
Largest New Motor Inventory in New England.

SANDMAN Electric

SANDMAN ELECTRIC CO., INC.

165 OLIVER ST., BOSTON 10, MASS.
SALES & SERVICE Tel. HUbbard 2-6750

New England's Leading Electric Motor Distributor

1—Edge Moor 1000 H.P. Longitudinal drum water tube boiler 200# pressure, complete with all regular fittings. Foster wheeler 125° Internal Superheater. Last Operated in 1949.

Last inspected in April 1950, and approved for operation under Penna. State Laws for Pressure Vessels.

American Engineering Co. Type AA-6 11 retort Taylor Mechanical Stoker. American Blower Corp. 7" x 7" type A vertical slide valve Steam Engine. B. F. Sturtevant Co. type M fuel economizer and 66" Multivane forced draft fan. Also size 10 design 3 multivane induced draft fan. Complete details on request. To be sold as is, where is.

FS-1629, POWER
330 West 42nd Street
New York, N. Y.

BUY From L. J. LAND for

- Dependable Equipment
- Reliable Rebuilding
- 1 YEAR GUARANTEE
- REAL VALUES

1 to 50 HP
NEW and REBUILT
TEFC—EX. PR.—Drip proof and Splash proof—Geared Head
IN STOCK

SQUIRREL CAGE MOTORS
3 phase

H.P.	Make	Type	Speed
250	West.	CW	450
200	Al. Ch. (2)	BB	880
200	G.E.	KF-6335	880
150	West.	CS	580
100	G.E.	K-544	1175
75	West. (2)	CS-654C	1750
75	Cont. (2)	TEFC	870
75	G.E.	IK	900
75	G.E.	KT-352	865
75	West.	CS	720
60	F-M	TEFC (2)	1750
60	Howell	SCR	1800
60	West. (2)	CS-607	880
60	Rel.	AA	875
60	G.E.	KT-346	865
60	G.E. (2)	TEFC(GH)	427
50	G.E.	FTR-523	3600
50	Elliott	196	3450
50	West.	CS	1740
50	West.	XP	1150
50	G.E.	KF-445	1170
50	West.	CS-624C	1160
50	West (2)	CS	870
50	G.E. (2)	IK	870
50	G.E.	FTR-542	870
50	West.	CS	690

SLIPRING MOTORS
3 Phase

H.P.	Make	Type	Speed
600	Cr. Wh.	131AQ	507
500	G.E. (2)	1M	450
500	Ideal		1150
400	G.E.	1M	870
225	Wagner	25 cy.	710
200	G.E. (2)	1M	1170
150	Wagner	31VRN	900
150	Burke		720
125	Burke		600
125	G.E. (2)		1200
75	G.E.	MT	1150
75	West.	CW	720
75	G.E.	MT556	900
75	G.E.	1M	690
60	West.	HF	850
60	Al.Ch.		690
50	G.E.	MT-536	1150
50	West.	CW	1150
50	L.A.	OGH	870
50	F.M.	BV	600
50	Al.Ch.	ARY	575
50	G.E.	1M	490

SYNCHRONOUS MOTORS

H.P.	Make	Type	Speed
475	West.		720
300	G.E.	ATI	900
260	G.E.	TS	900
200	West.	Unused	900
180	G.E.	ATI	900
150	G.E.	TS	720
150	G.E.	ATI	900
135	West.	G	1200
100	Elec.Prods.		1200
55	El.Machry.	BRKT	1200

230 V.D.C. MOTORS

H.P.	Make	Type	Speed
200	West.	SK210	575
150	G.E.	L.C.	1750
100	Al.Ch.		1150
90/45	G.E.	RF-17	950/475
75	Sprague		1000/1500
75	G.E.	RC36	800
75	West (2)	SK-180	475
75	Cr.Wh.	CMC	375/950
75	E-D	25S	450/1350
75	West.	SK151	250/1000
60	West. (3)	SK-160	680
50	GF.E.	RC-12	1750
45/90	G.E.	RF-17	475/1950
50	West. (3)	SK-160	565
50	G.E.	CD	3600
50	G.E.	RF-17	250/1000
50	West.	SK	250/1000
40	West.	SK-103	1750
40	Century	DN-454	1740
40	G.E.	RC-31	1700
40	G.E.	RC-32	1100
40	G.E.	RC-34	750
40	G.E. (2)	CD-1441	400/1500
40	Cr.Wh.	CCM	700
40	Rel.	461T	400/1200
35	West.	SK	250/1000
35	West.	SK-120	1150
35	G.E.	RLC	440/800
30	West.	SK	975
30	Cont.	D-103	850
30	G.E.	RC-33	775
30	West.	SA	500/1500
30	West. (2)	SK-143	575
25	G.E.	RC-15	1750
25	West.	SK-83	1750
25	G.E.	*CDM-77	1750
25	E.D.	108	1500
25	Rel.	92T	1150
25	West.	SA	500/1500
25	West. (2)	SK-130	600
25	G.E.	RF-14	300/1200

115 V.D.C. MOTORS

H.P.	Make	Type	Speed
300	West.	SK	900
100	Cr.Wh.	CMC	900
50	G.E.	CD	1150
40	G.E.	CD-113	850
30	West.	S	600
25	G.E. (2)	CD	1800
25	West.	SK-103	1150
25	Cr.Wh.	CCM	750
25	West.	SA	600/1200
15	E.D.	7½S	650/1230
15	Cr.Wh.	CM	650
10	Al.Ch.		900
10	E.D.	7½S	425/1700

550 V.D.C. MOTORS

KW	Make	Type	Speed
765	G.E. (3)	MPC	1045/1350

AC GENERATORS

KW	Make	Speed
180	G.E.	ATB	900
100	G.E.	ATB	360
15	G.E.	ASI	1200

AC GENERATORS
Driven by DC Motors

KVA	Make	D.C. Input	A.C. Output
62½	G.E.	230	240
50	Star	115	120
35	G.E.	230	220
31	Ideal	115	440
31	Ely. Machry.	230	440
18	G.E. (3)	230	120/240
10	Burke	115	120
7½	Hertner	115	440
6¼	G.E.	230	240
5	El. Spec.	115	110
1¼	Al. Ch.	230	110

600 V.D.C. GENERATORS

KW	Make	Speed
400	G.E. (4)	1200
325	G.E.	1200
30	Burke	1750
20	Reliance	1150

GENERATORS
250 V.D.C. Motor Driven

KW	Make	Speed
300	Elliott	1200
250	G.E.	1150
200	G.E.	1200
150	West.	900
100	Delco	1200
100	G.E.	700
75	G.E.	1200
40	Rel.	1750
42	ABC (2)	1200
30	G.E.	1200
25	G.E.	1200

125 V.D.C. Motor Driven

KW	Make	Speed
225	G.E. (2)	1200
150	West. (2)	1200
100	West. (2)	900
100	G.E.	1200
100	El. Machry.	1200
100	West.	1200
50	West. (2)	1150
30	G.E.	1150
30	L.A.	1450
25	El. Machry.	1150

GENERATORS
Low Voltage D.C.

Amp.	Make	Voltage
2500	Chandeysson	6/12
125	Hobart	7½
500	Chandeysson	12
1500	Century	24
2000	G.E.	24V
150	G.E.	30
1000	G.E.	33
150	Watton	40
1000	Chandeysson	40
200	G.E.	42
1500	G.E.	50
1500	Century	60
1500	G.E.	60
1000	G.E.	75

FREQUENCY CHANGERS AND GENERATORS

Size	Make	Output Frequency
150 KW	G.E.	150 cy.
154 KVA	G.E.	150 cy.
15 KW	G.E.	408 cy.
10 KW	G.E.	200/700 cy.
7½ KW	G.E.	408 cy.
3 KW	G.E.	408 cy.

ELECTRIC HOISTS

1000# Y & T—D.C.
1000# Thor—Air.
1000# Y & T—A.C.
1000# Shepard—A.C.
2000# R & M—D.C. (3)
2000# C & M—D.C.
4000# Thor—Air
6000# R & M—A.C.

STARTERS—D.C.

1—600 H.P. 230V. West. magnetic.
150—New 230V. D.C. magnetic starters, from 5 H.P. to 75 H.P. C-H, G.E., etc.
40—New 7½ H.P. 230V. magnetic reversing.
1—300 H.P. West. 115V. magnetic.

GUARANTEE
YOUR INVESTMENTS!

- LAND gives 1 year guarantee.
- All equipment listed in stock.
- You can see your machines run and tested under power before shipment.
- Complete shop facilities with thoroughly trained & experienced mechanics (many have been with us over 25 years).
- Responsible Organization — 41 years' experience.

Partial List ONLY

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156 GRAND STREET — Phone CAnal 6-6976 — NEW YORK 13, N.Y.

SLIP RING MOTORS

220 or 440 volt, 60 cycle, 3 phase, slip ring Motors Rebuilt

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
400	G.E.	I-M	1200	S. B.
300	G.E.	I-M	1200	S. B.
200	G.E.	I-M	1200	S. B.
150	G.E.	I-M	1200	S. B.
150	G.E.	I-M	1800	S. B.
100	G.E.	MT-300	1800	S. B.
100	G.E.	I-M	900	S. B.
100	G.E.	I-M	720	S. B.
75	G.E.	MT-343	1200	S. B.
75	G.E.	I-M	900	S. B.
75	West.	CW	720	S. B.
75	G.E.	I-M	720	S. B.
60	G.E.	MT-333	1800	S. B.
40	G.E.	I-M	1800	S. B.

BRAND NEW SQUIRREL CAGE MOTORS

Totally enclosed, fan cooled, explosion proof, open 220 or 440 Volt, 60 Cycle, 3 Phase

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
150	G.E.	K-6326	3600	TEFCBB
150	G.E.	K-6326	1800	TEFCBB
125	G.E.	K-6326	1200	TEFCBB
100	West.	CS-6078	1500	TEFCBB
100	West.	CS-504	1800	B. B. open
75	West.	CS-504	3600	TEFCBBXP
75	A.C.	ANZ	1800	TEFCBB used
75	West.	CS-504	1800	TEFCBBXP
75	West.	CS-445	1800	B. B. open
75	F.M.	QB-445	1800	B. B. open
75	West.	CS-505	1200	TEFCBBXP
60	West.	CS-5048	1800	TEFCBBXP
60	G.E.	K-5048	1800	TEFCBBXP
60	L.A.	DB-44	1800	B. B. open
60	F.M.	QS-444	1800	B. B. open
50	Master	FB-404	3600	TEFCBBXP
50	G.E.	K-445	1800	TEFCBB
50	G.E.	K-405	1800	S. B. drip
50	West.	CS-445	1200	S. B. open
50	G.E.	K-505	900	TEFCBBXP
40	A.C.	AR-444	3600	TEFCBBXP
40	G.E.	KF-3858	3000	B. B. splash
40	West.	CS-405	1800	TEFCBB
40	L.A.	K-405	1800	TEFCBBXP
40	G.E.	404	1800	B. B. open
40	Cr. Wh.	SC-445	1200	TEFCBB
30	G.E.	KF-3658	3000	B. B. splash
30	West.	CS-3656	3600	S. B. splash
25	Line.-Weld	DBD-328	3000	B. B. open
25	West.	CS-364	1800	S. B. splash
25	G.E.	K-364	1800	S. B. drip
20	G.E.	K-364	1800	S. B. drip
20	L.A.	EX-364	1800	TEFCBBXP
20	G.E.	KF-404	1200	TEFCBBXP
20	G.E.	KG-405	900	TEFCBBXP
20	G.E.	KF-405	900	TEFCBBXP
15	L.A.	EX-328	1800	TEFCBBXP
10	West.	CS-2942	3600	TEFCBB
10	Howell	EKBB-28-5	1800	TEFCBBXP
10	Reliance	AA-CB-324	1800	TEFCBB
10	West.	CS-324	1800	TEFCBB
10	West.	CS-324	1800	B. B. open
10	L.A.	EX-326	1200	TEFCBBXP
10	G.E.	K-364	900	S. B. drip
10	L.A.	R-1838	600	TEFCBB
5	G.E.	K-224	3600	TEFCBBXP
3	L.A.	EX-223	1800	TEFCBBXP

SQUIRREL CAGE MOTORS REBUILT

220 or 440 Volt, 60 Cycle, 3 Phase, Open

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
200	Wagner	RP-2-26	1800	S. B.
200	Wagner		1200	S. B.
200	G.E.	K-564	900	B. B. new
150	West.	CS	1800	S. B.
150	G.E.	I-K	1200	S. B.
150	G.E.	I-K	720	S. B.
100	West.	CS	1800	S. B.
100	G.E.	I-K	1800	S. B.
100	G.E.	I-K	1200	
100	G.E.	KT-347	1200	S. B.
100	West.	MS	1200	S. B.
100	West.	CS	900	S. B.
100	G.E.	I-K	720	S. B.
75	West.	CS	1800	S. B.
75	West.	CS	1200	S. B.
75	G.E.	I-K	900	
75	G.E.	KT-343	1200	S. B.
75	West.	CS-WL-607	1200	S. S. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-346	720	S. B.
60	G.E.	KT-333	1800	S. B.
60	G.E.	I-K	1200	S. B.
60	West.	CS	1200	S. B.
60	G.E.	KT-346	900	S. B.
60	G.E.	I-K	900	S. B.
50	G.E.	I-K	1800	S. B.
50	Cr. Wh.	25R	1800	S. B.
50	G.E.	KT-327	1800	S. B.
50	G.E.	KT-336	1200	S. B.
50	West.	CS	1200	S. B.
50	G.E.	KT-342	900	S. B.
50	G.E.	KT-346	900	S. B.
40	G.E.	K-444	1800	B. B.
40	G.E.	KT-323	1800	S. B.
40	West.	CS	1200	S. B.
40	G.E.	KT-336	900	S. B.
40	F.M.	B-H12D	900	S. B.
40	G.E.	KT-542	720	S. B.
35	Triumph	B-12	900	S. B.
35	G.E.	I-L	900	S. B.
35	G.E.	I-K	720	S. B.
30	G.E.	KT-312	1800	S. B.
30	West.	CS	1200	S. B.
30	G.E.	KT-332	900	S. B.
25	G.E.	KT-312	1800	S. B.
25	West.	CS-471	1800	S. B.
25	Century	SC-30	1200	S. B.
25	G.E.	I-K	720	S. B.
25	F.M.	B-H12-B	720	B. B.
20	West.	CS-364	1800	S. S. B. splash

We have in stock explosive proof motors 220/440/60/3 ranging in HP from ½ to 50 HP 900 to 1800 RPM.
We also carry in stock a large quantity of used electric motors from 1 HP up to 500 HP., generators, transformers and control equipment. Upon receipt of your inquiries, we shall be glad to quote.

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

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1—375 KVA—240/5/60 Westinghouse geared non condensing turbine.
2—37½ KVA—240 & 480/3/60 Cat. diesel sets.
1—50 KW—220 AC & 250 DC West. M.G. Set.
1—1000 HP—270 lb. Springfield boiler.
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676 FT. WORTHINGTON, 2 STAGE
1302 FT. INGERSOLL RAND PRE-2
1578 FT. SULLIVAN WN-31
2415 FT. INGERSOLL RAND PRE-2
2600 FT. SULLIVAN WN-4
2873 FT. WORTHINGTON, 2 STAGE
3100 FT. SULLIVAN WN-4
3460 FT. CHGO. PNEU. OCTDE

DIESEL GENERATORS

2—600 KW INGERSOLL RAND 2400 V.
1—600 KW GEN. MOTORS 2400 V.
1—190 KVA BALDWIN DELAVERGNE 440 V.
1—185 KVA FAIRBANKS MORSE 220 V.

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GENERATOR SETS

100 KW **200 KW**

General Motors Diesel engine, 8 cyl., Model 8-268A, 6½" bore x 7" stroke. Direct conn. to: 200 KW General Electric ALTERNATOR, 3 Phase, 60 Cycles, 440 Volts, Inc. Switchboard.

***ALSO*—COMPLETELY REBUILT**

General Motors 3 Cylinder Diesel Engine Sets Direct Conn. to: 100 KW WESTINGHOUSE ALTERNATORS, 3/60/440 Volts. Including Switchboards.

OTHER SIZES IN STOCK FROM 15 TO 1000 KW

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FOR SALE

Complete Soot Blower Equipment includes Operating Heads, Elements, Bearing Assemblies, Bearing and Wall Boxes—Never Used.

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TURBINE UNITS

1—15630 KVA G.E. Cond. 60 cy. 13200 V. 275-lb.
1—12500 KVA Allis Cond. 60 cy. 13800 V. 300-lb.
1—10000 KVA G.E. Cond. 25 cy. 6600 V. 200-lb.
1— 6250 KVA Allis Cond. 60 cy. 4000 V. 175-200-lb.
1— 5000 KVA West. Extr. Cond. 60 cy. 480 V. 385-lb.
1— 3750 KVA G.E. Cond. 60 cy. 2300 V. 185-lb.
1— 2500 KVA Worthington Non-C. 60 cy. 2300 V. 150-200-lb. 40-lb. BP
1— 2500 KVA G.E. Extr. Cond. 60 cy. 480 V. 185-200-lb. Steel Valve Chest.
2— 2250 KVA G.E. Cond. 60 cy. 240-400-lb.
1— 1875 KVA West. Cond. 60 cy. 2300 V. 170-lb.
1— 1875 KVA G.E. Cond. 60 cy. 2300 V. 180-lb.
1— 1563 KVA G.E. Extr. Cond. 60 cy. 2300 V. 200-lb.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 150-200-lb.
1— 938 KVA G.E. Extr. Cond. 60 cy. 240 V. 200-lb.
1— 750 KVA G.E. Extr. Cond. 60 cy. 480 V. 200-lb.
1— 625 KVA G.E. Non-C. 60 cy. 2300 V. 180-lb. 35-lb. BP
1— 625 KVA West. Cond. 60 cy. 480 V. 150-lb.
2— 250 KVA Elliott Non-C. 60 cy. 208 V. 200-lb. 5-lb. BP

DIESEL ENGINE UNITS

1—1600 HP Fair. Morse 2300/4150 V. 60 cy.
1—1000 HP Superior 2300 V. 60 cy.
1— 900 HP Amer. Loco. 250 V. DC
3— 650 HP Amer. Loco. 440 V. 60 cy.
1— 250 HP Buckeye 240 V. 60 cy.

STEAM ENGINE UNITS

1—875 KVA Chase Corliss 2300 V.
1—375 KVA Skinner Uniflow 480 V.
1—250 KVA Ames Vertical Uniflow 480 V.
2—187 KVA Ames Vertical Uniflow 240/480 V.
1—156 KVA Ames Vertical Uniflow 240 V.

ROTARIES — 60 CY.

QU.	KW	MFR.	VOLTS-DC	TRANS.	RPM
1	3250	G.E.	225/285	13800	300
3	1000	G.E.	600	13200	900 Auto.

SYNCHRONOUS CONDENSERS

QU.	KVA	MFR.	VOLTAGE	RPM
1	2500	G.E.	2400/4160	720
1	2000	West.	2300	720
1	1500	G.E.	4600	900
1	1500	West.	2300	900

SPECIAL

1—150 HP General Electric synchronous motor starter, cubicle type, type CR-7811, across-the-line, reversing, dynamic breaking.

MERCURY ARC RECTIFIERS

QU.	KW	KIND	DC VOLTS	TRANS.
2	4500	Multi Anode	600	13800
4	3250	Ignitron	650	33000
2	1850	Ignitron	360	33000

MOTOR GENERATOR SETS—60 CY.

QU.	KW	MFR.	VOLTS-DC	A.C.	RPM
2	1500	G.E.	660	13200	720
1	1000	G.E.	600	13200	514
1	500	West.	125	2300	720
1	400	G.E.	250	6600	720
1	75	West.	125	440	1200

SYNCHRONOUS MOTORS—60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	4350	Cr. Wh.	13800	514
2	1750	G.E.	2200	3600
2	700	West.	2300	200
1	600	G.E.	440	360
2	350	G.E.	2300	257
1	300	G.E.	2300	600
1	300	West.	2300	900

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	3125	G.E.	25/60	300
1	3000	G.E.	60/25	300
1	2500	G.E.	25/62½	750
1	2450	G.E.	62½/25	750
1	1700	West.	60/24	720
1	1500	G.E.	25/62½	750
1	1250	G.E.	25/60	300

TRANSFORMERS — 60 CY.

1— 7500 KVA G.E.	138000—41000, 3 ph.
3— 3333 KVA West.	132000—7620/13200 Y
3— 150 KVA Mol.	69000—7200/12470 Y
3— 1000 KVA West.	66000—7200
3— 500 KVA G.E.	66000—2400
1— 2500 KVA G.E.	59/73 KV—5 taps, 3 ph.
4— 2500 KVA West.	44000—11000
3— 1500 KVA Wag.	44000—6900 NEW
3— 200 KVA Mol.	44000/22000—440/220
3— 75 KVA West.	44000—7200/12470
5— 8333 KVA West.	43800—13900
3— 100 KVA Wag.	36000—7200/12470 Y
1—18750 KVA A.B.B.	34840—11000, 3 ph.
2— 7500 KVA West.	33000—6900/13800, 3 ph.
6— 1500 KVA Pitts.	33000—2400
3— 200 KVA West.	33000—7200/12470 Y
3— 200 KVA West.	33000—2400
3— 167 KVA G.E.	33000—2300/4000 Y
6— 150 KVA G.E.	34500—2300/4600
4— 150 KVA G.E.	33000—7200/12470
6— 75 KVA Mol.	33000/16500—2300 6900
3— 75 KVA Wag.	33000—7200/12470 Y
6— 50 KVA G.E.	33000—2300
4— 450 KVA A.C.	25410/44000—13280/23000
4— 750 KVA Wag.	19050/33000 Y—6900/11950
2— 200 KVA G.E.	11500—220/110
3— 500 KVA A.C.	11000—2300
3— 200 KVA Mol.	11000—2300
3— 37½ KVA Pitts.	6900—230/460
3— 75 KVA West.	6600—460/230
3— 100 KVA Kuhl.	550—220/110
4— 15 KVA Stand.	450/225—117

OIL CIRCUIT BREAKERS

4—600 A. 154 KV G.E. FHKO-39-2500	Outdoor
1—600 A. 132 KV G.E. FHKO-60-1500	Outdoor
2—600 A. 73 KV G.E. FHKO-139-1000	Outdoor
1—400 A. 73 KV G.E. FHKO-236-500	Outdoor
1—600 A. 37 KV G.E. FHKO-139-450	Outdoor
1—400 A. 27 KV G.E. FHKO236-500	Outdoor
1—400 A. 37 KV Condit FO-40-B-750	Outdoor
4—600 A. 15 KV G.E. FHKO-139-750	Outdoor

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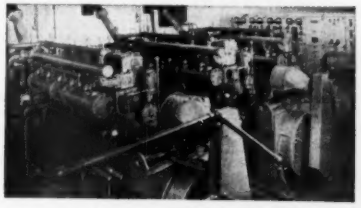

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M-G SETS

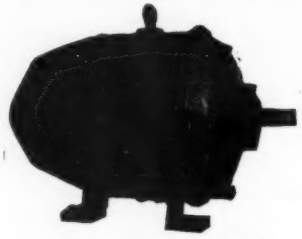
KW	D.C. Volts	A.C. Volts	Mfg.
500	250	2300	Whse.
400	250	2300	Whse.
300	250	2300	Whse.
200	250	2300	Ridgeway
150	250	440	Whse.
100	250	2300	G.E.
75	250	220/440	G.E.
50	250	440	G.E.
30	250	440	Ideal
30	125/250	2300/4000	G.E.
20	250	220/440	G.E.
7½VS	250	220/440	Rel.
3VS	250	220/440	Rel.

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
650	138	2300	Whse.	Engine
400	900	2300	Whse.	80%
350	600	440	Whse.	100%
250	200	440	G.E.	85%
200	900	440	E-M	80%
200	720	440	G.E.	100%
150	600	440	G.E.	100%
100	900	440	G.E.	100%
75	1200	440	G.E.	80%
10	1800	220	Whse.	80%

SLIP RING

HP	RPM	Volts	Mfg.
500	1200	220/440	Elliott (new)
400	900	2300	G.E. (new)
350	450	2300	Whse.
200	450	2300	Burke
50	720	220	Whse.
50	900	220	G.E.
40	900	220	G.E.
7½	1800	220	Rel. (New)



NEW DIRECT CURRENT

230 volt-dripproof

Qu.	HP	RPM	Mfg.	Frame
1		690/2660	G.E.	284
10	5	850/1700	G.E.	CD-66
5	7½	575/1725	G.E.	CD-77
1	7½	575/1725	Rel.	46T
1	7½	1750	Rel. (TE)	14T
1	10	575/2300	L.A.	4051
1	30	300/1800	G.E.	CD-1377

CRADLE TYPE DYNAMOMETER

225 HP, Whse, 250 v. DC, 300/2000 RPM, complete with Toledo automatic printing type scale and all necessary control.

230 V. DIRECT CURRENT

Reconditioned & Guaranteed

HP	RPM	Mfg.	Brgs.
150	250/1000	Rel	Sl.
100	450/1350	Whse.	Sl.
50	500/1500	G.E.	Sl.
40	400/1200	Rel (TE)	Ball
35	400/1200	Ideal	Sl.
30	250/1000	Whse.	S.Sl.
30	500/1500	C-W (TE)	BB
30	500/1500	Rel	Ball
25	250/1000	G.E.	Sl.
25	400/1600	Whse.	Sl.
25	600/1350	Rel	Ball
25	690	Rel	Ball
20	250/1000	Whse.	Sl.
20	30/1200	Rel.	Ball
20	500/1500	G.E.	Sl.
15	250/1000	G.E.	Sl.
15	400/1600	Whse.	Sl.
15	400/1200	G.E.	Sl.
15	575/1000	Rel	Ball
15	575/1725	L.A.	Ball
15	650/1650	G.E.	Sl.
15	700/1350	Rel	Ball
10	300/1200	Whse.	Sl.
10	400/1600	Whse.	Sl.
10	400/1600	Rel	Ball
10	600/1200	Rel (TE)	Ball
10	850	Rel (TE)	Ball
10	1750	G.E. (TE)	BB
7½	200/1200	Whse. (TE)	Ball
7½	300/900	G.E.	Sl.
7½	400/1600	Rel	Sl.
7½	400/1600	Whse.	Ball
7½	450/1200	C-W	Sl.
7½	600/1800	Rel (TE)	Ball
7¼	1150	G.E.	Sl.
3	850/1700	Rel	Ball

Buy from BOSWICK with confidence

WAlbridge 1195

BOSWICK ELECTRIC CO.

P.O. BOX 55 AKRON 9, OHIO

FOR SALE

6 OIL FIRED B & W BOILERS

Heating Surface	11417 Square Feet
Horse Power	1141.7
Design Pressure	200 P.S.I.G.
Working Pressure	200 P.S.I.G.
Capacity—Normal	75,000 lbs./hr.
Steam Temperature	Saturated
Furnace Volume	1024 Cubic Feet
Feed Water Temperature	200°
Tubes	1¼" bent—825
	1¼" str. —1667—12'2" long
	2" straight — 122—12'2" long
	3¼"str. — 16
First 2 rows of Tubes above fire box are 2"	
Downcomer & Uptake Tubes	4" & 4½" bent
Oil Burners per Boiler	8
Boiler Dimensions	Width—19'4"
	Height—16'4½"
Water Wall Sides in Furnace	Depth—15'

The above units presently aboard S.S. George Washington. Installed new 1943.

WRITE—WIRE—PHONE: MARINE DEPARTMENT

The BOSTON METALS Co.

313 E. Baltimore St. Baltimore 2, Md.

CURTIS 5050-5051

FOR SALE
COMPLETE
STEAM POWER PLANT

5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, with Hoppers, Automatic Coal Conveyors, Automatic Ash Conveyor, 36" x 24" Jeffrey Flex-Tooth Coal Crusher.

1—705 HP Stirling 4 dum BOILER with B&W U-type superheater.

1—10,000 KW Allis-Chalmers STEAM TURBINE.

1—7,500 KW Allis-Chalmers STEAM TURBINE.

1—7,500 KW General Electric STEAM TURBINE.

All with complete control equipment.
Send for complete inventory in Denver.

MORSE BROS. MACHINERY COMPANY

2900 BRIGHTON BLVD.
BOX 1708 DENVER 1, COLORADO

POWER EQUIPMENT—READY TO SHIP

A.C. MOTORS

220/440 volt 3 ph. 60 cy.

HP	MAKE	RPM	TYPE
300	Elec. Mach.	1800	Syn. 2200 v.
300	Elec. Mach.	1800	Syn.
250	Gen. Elec.	515	tefc. KF-576
250	Burke	720	syn.
250	Gen. Elec.	1175	I-2200 v.
250 (4)	Westg.	1775	CS-8758
225	Elec. Mach.	1800	Syn.
200	Gen. Elec.	430	tefc. KF-576
200	Gen. Elec.	900	2200 v.
200 (3)	Wagner	1750	220/440
200	Gen. Elec.	1800	2300 v. syn.
175	Westg.	1200	MS
150	Westg.	257	Syn.
150	Gen. Elec.	400	KF-576, 2200 v.
150	Gen. Elec.	400	tefc.
150	Westg.	600	syn.
150	Westg.	1200	hd-torq.
150 (3)	Gen. Elec.	1770	vert.
150	Gen. Elec.	1770	tefc. 2200 v.
150	Elec. Mach.	1750	Syn.
125	Elec. Mach.	164	Syn.
100	Fairbanks-Morse	360	Syn.
100	Gen. Elec.	875	KT-356
100 (2)	Gen. Elec.	1200	tefc.
75	Elec. Mach.	900	Syn.
75	Louis Allis	1800	FX-5058
60	Triumph	1200	H-133
60	Gen. Elec.	1800	KT-533
50 (3)	Westg.	900	550/220/440
50	Gen. Elec.	1150	KT-336
50 New	Reliance	1760	tefc.
50 New	Gen. Elec.	1800	tefc. K-504
40	Gen. Elec.	570	KT-546
40	Cr. Wh.	720	
40	Westg.	900	Syn.
40	Gen. Elec.	855	KT-336
40	Gen. Elec.	1200	KT-332
40	Gen. Elec.	1630	KR-444
40	Allis-Chal.	1800	
40	Gen. Elec.	3600	FT-513Y
35	Westg.	630	
35	Ouan	1800	Syn.
30	Gen. Elec.	790	hd-torq.
30	Gen. Elec.	860	KT-332
30	Allis-Chal.	1750	
30 New	Louis Allis	1800/1200	
30 (2)	Gen. Elec.	3600	KT-205
25	Commonwealth	560	504
25 (2)	Westg.	865	CS
25/7½	Continental	1150/575	
25	Howell	1200	SC
25	Westg.	1160	CS
15	Gen. Elec.	570	KT-326
15	Gen. Elec.	900	I-K
15	Westg.	965	CS
15 New	Gen. Elec.	1150	hd-torq.
15	Louis Allis	1150/1740	OMX-404
15	Louis Allis	1750/566	FX-365Y
15	Louis Allis	1750	OX-326
5 (9)	Gen. Elec.	1150	tefc.
5 (50)	Westg.	1150	CS

SLIP RING MOTORS

3 ph.—60 cy.

HP	MAKE	RPM	TYPE	VOLTS
600	West.	438		2200
350	West.	360		2200
200	West.	500	CW-1000	220/440
150	West.	870	CW-874C	2200
150	West.	870	CW	220/440
100	Triumph	580		550/440/220
75	Gen. Elec.	600	IM	550/440/220
60	Gen. Elec.	570	MTC-5346	220/440
60	Burke	1200	emv-7	220/440
50	All.-Chal.	690		220/440
50	Gen. Elec.	900	IM	220/440
50	West.	860	ci-628A	220/440
50	Gen. Elec.	865	MT-346	220/440
50	Wagner	1140		220/440
50	Gen. Elec.	1200	MT-342	220/440
40	Gen. Elec.	1170	MT-336Y	550/220/440
35	Gen. Elec.	865	I-M	2200
35	West.	690	ci-646	220/440
35	Gen. Elec.	690	I-M	220/440/220
30	All.-Chal.	575	ARY	220/440
30	West.	870		220/440
25	Gen. Elec.	650	MTC-5326	220/440
25	West.	570	CI	220/440
20	West.	1200		220/440
15	All. Chal.	575		2200
15	West.	835	CW-546	220/440
15	West.	870	CW	220/440
15	Howell	1800	SR	220/440
10	West.	600	CW-504	440

SPECIAL BARGAINS

Diesel Engine Generator Sets

2—100 kw., 120/240 v. D.C. Delco Generators dir. con. to 250 HP Model GBD-8, 5½x7, 8 cyl. Superior DIESEL Engines, elec. start with engine panels.

2—100 KW same as above with 220 or 440 v. NEW A.C. Generators.

10—37½ kva. 3 ph 60 cy. 127/220 v. or 220/440 v. 1200 rpm., Century A.C. Generators with dir. con. exciters driven by 70 HP., 4 cyl. Model UD-14 International Harvester DIESEL Engines with panels.

1—Unused 37½ kva., 3 ph. 60 cy. 127/220 v. or 220/440 v. Century 1800 rpm., dir. con. exciter driven by 72 HP., Model 6DTG317, Buda Diesel Engine with panel.

1—80 kva. Fairbanks Morse 220/440 v. 3 ph. 60 cy. 360 rpm DIESEL.

4—25 kva. 120 v. 1 ph. 60 cy. Westinghouse dir. con. to 5E MP., 4 cyl. 900 rpm., LeRoi Gasoline Engines with control panels.

5—25 kw., 220/440 v. 3 ph. 60 cy. Westinghouse direct connected to 4 cyl. LeRoi Gasoline valve in head liquid cooled Engine complete with control panels.

CLEANING MILL

1—Ransohoff Cleaning Mill 48" x 72", side loading side unloading, star return, with sand handling conveyor complete with tank, pump and motors.

GEARHEAD MOTOR

1—NEW 10 Hp., Westinghouse 220 v. 3 ph. 60 cy. 900 rpm., to 20 rpm type FD-226F, frame W326 type CS.

VARIABLE SPEED MOTORS

230 Volt D.C.

HP	Speed	Make	Type
100	500/1900	Westinghouse	SK-190
100	625/1250	Westinghouse	S-13 L
75	600/1200	Westinghouse	—
50	300/1200	Crocker Wheeler	CMC
40	385/1200	Elec.	—
40	250/1000	Westinghouse	SK-141
35	350/1400	General Electric	BF16A
25	300/1200	General Electric	CD-123
25	325/975	Westinghouse	—
25	500/1500	Westinghouse	SK-110L
20	400/1600	Westinghouse	SK-122
20(3)	500/1500	Westinghouse	SK-110L
15(2)	400/1600	Westinghouse	SK
10(2)	500/2000	Westinghouse	SK-103
10(6)	400/1600	General Electric	—
5(6)	400/1600	Westinghouse	SK-70

MOTOR GENERATOR SETS—

250 V. D.C.

Motors 220/440 volt or 2200 volt

No.	KW	Make	Rpm
2	200	Westinghouse	1200
1	100	Westinghouse	700
1	100	General Electric	900
1	100	Westinghouse	600
1	100	General Electric	1800
1	100	Reliance	580
1	100	Delco	1200

TRANSFORMERS

1 ph. 60 cy.

No.	Kva	Make	Primary	Sec.
3	500	West.	22000	2300
3	200	Fgh.	22000	2200
5	200	Allis-Chal.	4800	120/240
2	150	Fgh.	4600	115/230
1	110	Fgh.	4600	115/230
6	100	Fgh.	4600	115/230
2	100	Allis-Chal.	4800	120/240
2	100	G.E.	4600	120/240
1	75	Fgh.	4600	115/230

BAKER LOCOMOTIVE CRANE TRUCK

Model CYA 3000 lbs. at 7' radius with 8 to 12' adjustable telescoping boom complete with slow control, hoist control and boom control.

PUMPS

2777 GPM Fair. Morse Cent. 235' hd. 8" dis. 10" suc. 200 HP. A.C. Syn. Motor.

2083 GPM Fair. Morse Cent. 235' hd. 8" dis. 10" suc. 225 HP. A.C. Syn. Motor.

1382 GPM Fair. Morse Cent. 235' hd. dir. con. 150 HP. A.C. Syn. Motor.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

TURBO-GENERATORS

250 KW, 300 KW A.C. and D.C.

2000 KW 3 phase, 50 cycles, 6300 volts

Immediate delivery

Packed in original crates

Complete Specifications and Details Upon Request

INTERNATIONAL FERMONT MACHINERY CO., INC.
115 BROADWAY
NEW YORK 6, N. Y.

POWER PLANT EQUIPMENT

SPECIAL OFFERINGS

TURBO-GENERATORS

2—4000 KW, 2300 V., 150# Cond.
1—3500 KW, 4000 V., 150# Cond.
1—3000 KW, 4000 V., 150# Cond.
1—2500 KW, 480 V., 150# Cond.
1—2500 KW, 550 V., 250# Cond.
1—2000 KW, 550 V., 175# Cond.
1—1500 KW, 2300 V., 200# Cond.
1—1250 KW, 2300 V., 250# N.C.
2—1250 KW, 2300 V., 225# Cond.
1—1000 KW, 2300 V., 175# Extr.
1—1000 KW, 2300 V., 250# Cond.
1—1000 KW, 4150 V., 260# N.C.
2—1000 KW, 480 V., 180# Cond.
1— 750 KW, 550 V., 170# Extr.
1— 500 KW, 2300 V., 165# Cond.
1— 300 KW, 2300 V., 150# Cond.
1— 150 KW, 2400 V., 150# N.C.

ENGINE GENERATORS

1—600 KW, 2300 V., Unif.
1—500 KW, 230 V., D.C., Unif.
3—375 KVA, 550 V., Unif.
1—312 KVA, 440 V., Unif.

DIESEL GENERATORS

1—1000 KVA, 2400 V.
3— 540 KW, 480 V.

BOILERS

1—30,000#, 425#
1— 1,000 HP, 250#
2— 500 HP, 200#
1— 438 HP, 200#
2— 300 HP, 250#
2— 250 HP, 200#
6— 150 Hp, 150# Sc. Mr.
1— 78" H.R.T., 200#

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

THE BUYERS MUST BE SATISFIED—ALWAYS

2—150 KW Factory Built Motor Gen. Sets
1—540 KW 2300/440/220 V. Gen. Eng. Set
1—300 KVA—200 & 120 KW Diesel Elec. Sets
1—150 HP Westgs. 8lip Eg. Motor-Rebuilt
1—100 HP Dutton Horiz. Boiler—used 3 yrs.
1—35 Ton Diesel Switching Locomotive
2—72"x18' HRT Boilers 150#—complete

H. & P. 6719 Etzel, St. Louis 14, Mo.

BOILERS

Four 250 H.P. Heating Boilers, practically new Birchfield, Cade constructed, 15 lbs. W.P., complete with trim, Hay Oil Burners, Weston Pumps. Three Double Drum Heine 400 H.P., Code constructed for 150 lbs. W.P. new tubes.

H. P. ALEXANDER BOILER & ENG. CO.
4700 Long Beach Ave., Los Angeles 58, Cal.

BOILERS

10 to 5000 H.P.

Diesel, Steam Turbine, Engine

GENERATORS

Heavy Power Equipment
Industrial — Chemical Process Equipment

UNUSED — RECONDITIONED

DEAN G. STRICKLER & ASSOCIATES
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This Seal ...tells you what you buy is GOOD EQUIPMENT!

GUARANTEED GOOD BECAUSE REBUILT AND TESTED UNDER SUPERVISION OF

HEMPHILL ELECTRICAL ENGINEERS

TRANSFORMERS—60 Cycle

Qu.	KVA	MAKE	TYPE	Ph.	VOLTAGES
1	2500	Whse.	Hipersil	3	66000/33000 prl. 240/480 sec. w/Taps
3	1500	Pitts.			22000 prl., 2200 sec., w/Taps
1	1500	GE	Pyranol	3	4150x2200V
1	500	Kuhl.	OISC	1	4600x2300V
2	400	GE	H	1	6900x2250V
1	300	Pitts.	ODSC	1	7800x440V
1	200	GE	HT	3	2300x220
1	200	Whse.	Auto	3/2	4150x2300
1	200	Pitts.	ODSC	1	6000x110/220
1	200	GE	Auto	3/2	4150x2400
1	150	GE	ES	1	2300x230
1	100	Pitts.		1	2770x110/220
1	100	Wagner	RCKV	1	240x120/120
1	100	Whse.	SK	1	4400x220/110 Taps
1	75	Whse.		1	2400-210
1	50	Whse.	Interteen	1	2300x120/210

SPECIAL—WELDING MOTOR GENERATOR SET
1—176 KVA Whse. Welding Gen. Set, 1 Ph. 29V. 800 Amp 57% PF with Slip Ring Motor & Exciter

MOTOR GENERATOR SETS
3 Phase, 60 Cycle

Qu.	KW	MAKE	SPEED DC	AC
1	1000	GE	514 600	2300/4150 Syn.
1	300	GE	1200 250	2300 Syn.
5	200	Whse.	900 250	220/440 Syn.
1	150	GE	1200 125/ 250	2300 Syn.
1	150	Whse.	600 125	4150 Syn.
1	125	CW	1200 125	2300 SC
1	100	Al. Ch.	900 125/ 250	220/440 S.C.
1	100	GE	900 250	2300 Syn.
1	100	CW	1200 125	220/440 SC
1	100	El. Mach.	1200 125	4150 Syn.
3	94	GE	1200 60	440 SC
2	40	El. Mach.	1750 125	440 SC

SYNCHRONOUS

300 HP El. Mach. 720 RPM 2300 V T.E.F. C. outdoor Service
200/100 HP Whse. 720/360 RPM 4150 V.

SLIP RING

1	2500	GE	MT	6600	257
1	250	Whse.	CW	440	600
1	200	GE	MT	2300	1800
1	200	Whse.	CW	440	600
1	200	GE	MT	440	600
1	100	GE	IM	440	400
1	75	GE	MT	220	900 Vert
1	75	GE	MT	440	1900
1	60	GE	MT	220	1750
1	60	GE	MT	440	900
1	50	GE	MT	220	1720
1	50	GE	MT	220	1200
1	50	Whse.	CW	220	900
1	50	GE	MT	220	1700
1	50	GE	MT	220	600
1	40	GE	MT	220	1200

"FOR POWER"
J. L. HEMPHILL & CO.
1604 53rd STREET, NORTH BERGEN, N. J.
PHONE NEW YORK—LONGACRE 5-3227
PHONE NEW JERSEY—UNION 8-2600

Member of The National Industrial Service Association, Inc.

MOTORS—M.G. SETS—COMPRESSORS, ETC.

M.G. SETS & CONVERTERS

KW	MAKE	RPM	D.C.	A.C.
1250	GE	720	250	2360
750	Al. Ch.	720	250	440
500	GE Rotary	1200	250	2300
400	West.	720	550	2300
300 (2)	GE	1200	250	2300
300	GE Rotary	600	250	2300
300	GE Rotary	1200	250	2300
300	West.	1200	550	2300
200	GE	1200	250	2300
150	GE	900	250	2300
150	West. Rotary	1200	250	2300

AIR COMPRESSORS

350 CFM Chg. Ph. 12"x10" NSB 100#.
415 CFM Allis Rotary 100#.

A.C. MOTORS

HP	MAKE	RPM	TYPE
400	GE	450	Sl.Rg.
300	GE	450	Sl.Rg.
160	GE	600	Sq.Cg.
150	GE	600	Syn.
100 (2)	Allis	720	Sq.Cg.
100	West.	900	Syn.
100	West.	1200	Sq.Cg.
100	GE	1750	Sq.Cg.
100 (2)	GE	450	Sl.Rg.
75	West.	900	Sq.Cg.
75	GE	600	Sl.Rg.
60	West.	600	Sl.Rg.
50	GE	1750	Sq.Cg.
40	GE	900	Sl.Rg.
40	West.	900	Sq.Cg.

MOORHEAD ELECTRICAL MACHINERY COMPANY
361 Noblestown Road (Est. 1919) Oakdale, Penna. Pittsburgh District

John H. Benson Roy L. Wilimzig

MOTORS!! PUMPS!!

4—250 HP, 1170 RPM, Allis-Chalmers, Splash-Proof, Frame 630—DSWW, 3/60/2300.
1—150 HP—514 RPM, Westinghouse Slip-ring motor, 3/60/440. Can furnish Drum and Grids.
1—1000 KVA—AC Generator Westinghouse, 3/60/2300 V. 720 RPM
1—1000 KVA Synchronous Condenser, 3/60/2300/4000 600 RPM
2—24x24 Dayton Dowd CS24, 16,500 GPM 18.5/35 FT. HD. 360/450 RPM.

1000 other motors in stock!
Phone, Write or Wire!

BENSON-WILIMZIG, INC.
formerly C & S Machinery Co.
1708 N. 8th St. St. Louis, Mo.
GA-4290

SPECIAL TRANSFORMERS—YOUR SPECIFICATIONS

NEW TRANSFORMERS
OIL COOLED
AIR COOLED
PHASE CHANGES

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St., Philadelphia 34, Pa.
GArfield 5-0433

USED TRANSFORMERS
REWOUND
REBUILT
RECONDITIONED

FOR SALE

9000 feet of Used No. 4/0 Trolley Wire
8000 feet of Used No. 4/0 Trolley Feeder in lengths from 200 to 500 feet
135 Transformers—1½ to 200 KVA
Over 1000 DC and AC Motors, rebuilt and ready to go.

PORTER ELECTRIC CO., INC.
116-118 Third Avenue N.
Minneapolis 1, Minnesota
TRY PORTER FIRST

FOR SALE
ELECTRIC MOTORS

Large Quantity of Rebuilt Fairbanks-Morse Squirrel Cage Motors. Type QZAK. Fully Guaranteed One Year.

	220/440 VOLTS 3 PHASE 60 CYCLE	550 VOLTS
HP	RPM	PRICE
2	1200	$ 67.50
3	1200	76.50
5	1800	76.50
5	1200	99.50
7½	1800	99.50
7½	1200	129.50
10	1800	129.50

F.O.B. Our Plant

THE SANCO COMPANY, INC.
P.O. Box 27 Manchester, N. H.

EXCELLENT POWER UNITS

2—125 KVA Westinghouse AC generators, 440 Volts, 277 RPM. Powered by 2 Bruce Mac Beth gas/gasoline engines.
1—150-HP, 225 RPM, Synchronous motor. Real Bargains.

A A A IRON CO.
Canton & Hawkins Sts., Dallas 1, Texas

UNUSED CENTRIFUGAL PUMPS

3 Goulds 2" Fig. 3769 centrifugal pumps, 200 GPM at 70 ft. head at 1750 RPM. Bases and couplings for direct motor drive included. (Pumps in storage Jersey City.)

STOREY PUMP and EQUIPMENT COMPANY
510 Harbour Commission Bldg., Toronto 1, Canada

TURBO GENERATORS

25,000 KVA G.E. condensing, 200 lbs., 530° FTT, 13,200 volts.

15,625 KVA G.E. condensing, 250 lbs., 500° FTT, 13,200 volts.

12,500 KVA Allis condensing, 225 lbs., 550° FTT, 13,200 volts.

6,250 KVA Allis condensing, 200 lbs., 500° FTT, 2300/4000 volts.

5,000 G.E. non-condensing extraction, 600 lbs., 750° FTT, 125/150 lbs. extraction, 0-50 lbs. exhaust, 13,800/4000 volts.

3,750 KVA G.E. condensing, 150-250 lbs., 500° FTT, 2300/600 volts.

3,125 KVA G.E. condensing extraction, 800 lbs., 800° FTT, 200 lbs. extraction, 2300 volts.

2,500 KVA G.E. condensing extraction, 200 lbs., 550° FTT, 20 lbs. extraction, 480 volts.

1,875 KVA G.E. condensing, 150-250 lbs., 650° FTT, 2300 volts.

1,563 KVA G.E. condensing extraction, 250 lbs., 525° FTT, 15 lbs. extraction, 2300 volts.

1,250 KVA G.E. condensing, 200-400 lbs., 650° FTT, 2300/4150 volts.

1,250 KVA G.E. condensing extraction, 175-400 lbs., 700° FTT, 0-10 lbs. extraction, 2300 volts.

1,250 KVA G.E. non-condensing 175 lbs., 500° FTT, 15 lbs. exhaust, 2300 volts.

625 KVA Westg. non-condensing, 150-200 lbs. 600° FTT, 5-25 lbs. exhaust, 480 volts.

UNIFLOW UNITS

750 KVA Ames-Allis Chalmers vertical, 150 lbs. steam, 5 lbs. exhaust, 2400/4160 volts.

625 KVA Skinner-G.E., 150 lbs. steam, 5 lbs. exhaust, 240 volts.

500 KVA Skinner-G.E. 125 lbs. steam, 5 lbs. exhaust, 480 volts.

375 KVA (2) Elliott, 150 lbs. steam, 2 lbs. exhaust, 2300 volts.

312 KVA Skinner-G.E., 150 lbs. steam, 3 lbs. exhaust, 480 volts.

250 KVA (2) Skinner-E.M., 135 lbs. steam, 3 lbs. exhaust, 120/208 volts.

219 KVA (2) Skinner-G.E., 150 lbs. steam, 2 lbs. exhaust, 2300 volts.

BOILERS

1,500 HP Babcock & Wilcox, 100,000 lbs. per hour, 850 lbs. steam, 750° FTT, pulverized fuel.

825 HP Combustion Engineering 50,000 lbs. per hour, 275 lbs. steam, 525° FTT, pulverized fuel.

540 HP Keeler, 250 lbs. steam, pulverized fuel or oil fired.

350 HP Keeler, 250 lbs. steam, stoker fired.

350 HP (2) Wickes, 30,000 lbs. per hour, 350 lbs. steam, 600° FTT, oil and gas fired.

300 HP (2) Keeler, 10,000 lbs. per hour, 250 lbs. steam, 500° FTT, stoker fired.

150 HP (2) Erie City, 6200 lbs. per hour, 150 lbs. steam, stoker fired.

DIESEL GENERATORS

1,675 KVA Fairbanks-Morse, 2400/600/480 volts, 300 RPM.

1,388 KVA McIntosh-Seymour, 2300 volts, 300 RPM.

900 KVA Fairbanks-Morse, 2400 volts, 257 RPM.

880 KVA Worthington, 480 volts, 327 RPM.

695 KVA Fairbanks-Morse, 2400 volts, 300 RPM.

592 KVA Fairbanks-Morse, 2400 volts, 300 RPM.

546 KVA Worthington, 480 volts, 327 RPM.

478 KVA (2) Fairbanks-Morse, 2400 volts, 300 RPM.

312 KVA Superior, 480 volts, 360 RPM.

SPECIAL

1675 KVA Fairbanks-Morse generator, 3 phase 60 cycle 2400/600/480 volts, 300 RPM direct connected to 1750 HP F-M diesel engine, 2 cycle, 10 cylinder, Model 33E16, 300 RPM.

Complete with direct connected exciter, switchgear, and all auxiliaries as in operation. New 1942, excellent condition. Engine can be adapted for dual fuel operation.

RECTIFIER

1,000 KW G.E. Mercury Arc Rectifier, 600 volts DC, 60 cycle, 13,200 volts AC.

HIGH FREQUENCY GENERATORS

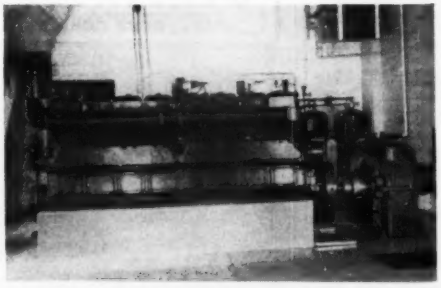
2,860 KVA (3) New G.E. AC generators, Type ATB, 3 phase, 120/240 cycles, 4150 volts, 4800 RPM

INTERNATIONAL POWER MACHINERY CO.

1609 UNION COMMERCE BLDG. Telephone: MAin 1-9514 CLEVELAND 14, OHIO

SURPLUS DIESEL POWER AND PUMPING EQUIPMENT

Excellent Condition for Immediate Delivery



PRESCOTT DOUBLE ACTING PLUNGER PUMPS

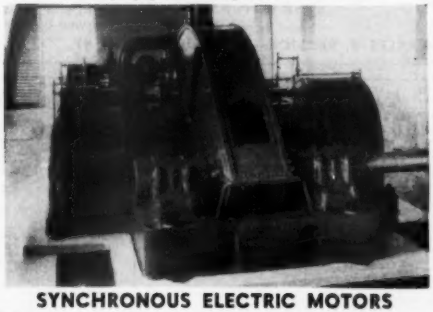
Quant.	Type	Stroke	Fluid Ends	Bbls/Day	Max. Press.
6	Duplex	24"	Cast Iron	20,000	800#
2	Duplex	24"	Fgd. Steel	20,000	900#
1	Triplex	24"	Fgd. Steel	30,500	900#

This equipment has been made available by the construction of a new 18" crude oil pipe line between Portland, Maine and Montreal, Canada, bringing about the elimination of four pump stations.

DIESEL ENGINES

Quant.	Make	Model	H.P.	RPM
2	Busch-Sulzer	6B100	600	225
2	McIntosh-Seymour	4B35	500	225
2	Chicago Pneumatic	89CP	400	750

Auxiliary Equipment and Spare Parts Available.



SYNCHRONOUS ELECTRIC MOTORS

Quant.	Make	H.P.	Volts	Speed
1	Westinghouse	475	2200	257
2	General Electric	500	2300	327

Starting and Control Equipment Available.

Detailed Specifications and Arrangements for Inspection Upon Request.

PORTLAND PIPE LINE CORPORATION

335 FOREST AVENUE, PORTLAND, MAINE

MOTORS • GENERATORS • TRANSFORMERS

7x7 AIR COMPRESSOR

Ingersoll Rand 7x7 Class ERI—100#—with or without drive.

1—400 KW Westinghouse 500 V. DC 750 RPM 800 Amps. Motor—580 HP. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V. DC. Direct connected to 50 HP. 3/60/440/1800 Gen. Elect. Motor.

600 HP GEAR REDUCER

1—600 HP Farrel-Birmingham Herringbone Gear Unit. Type SL. Size 30/16 Speed 730 RPM to 115 RPM.

400 HP GEAR REDUCER

1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3/60/2300/600 RPM.

100 HP Gen. Electric Type KT 356 3/60/2200/900 RPM.

125 HP Gen. Electric Type I form K 3/60/440/720 RPM.

125 HP Gen. Electric Type KT 3/60/2300/1200 RPM.

150 HP Gen. Electric Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/720 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP Gen. Electric Type KT 3/60/440/600 RPM.

250 HP Gen. Electric Type KT 3/60/440/720 RPM.

350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

MOTORS

250 HP Gen. Electric Synchronous Type ATI 3/25 cycle/2200/500 RPM.

350 HP Westinghouse Slipring Type CW, 3/25 cycle/2200/500 RPM.

400 HP Westinghouse, Synchronous 3/60/2300/900 RPM.

DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

125 VOLT DC MOTORS

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

1—150 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing.

Will make 1200 RPM 125 Volt Generators.

REBUILT TRANSFORMERS

3—100 KVA G.E. 1 ph., 60 cy., 2400/4160 pri., 120/240 sec.

3—1667 KVA Wagner 1 ph., 25 cy., 23,000 pri., 575 sec.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y.

CL. 4758

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

IMMEDIATE DELIVERY —2-ea.60,000# hr. capacity 4-Drum Stirling type, 250# psi, (10,000 sq. ft. H.S.) 525' F.TT Boilers. Condition excellent, suitable any fuel, now oil fired.

1—48,000# hr. capacity Boiler, otherwise same as 60,000# (8,500 sq. ft. H.S.) above boilers.

• We have many other boilers in sizes of 250 to 600 HP, 200 to 450# pressure. See our September Power ad.

Turbo-Generators, Condensing, 500 to 10,000 KW.
Turbo-Generators, Non-Condensing, 200 to 2500 KW.

Frequency Changers—Motor-Generators & Diesel-Generators

TRANSFORMERS! Quick Delivery, Various Sizes Rebuilt like NEW—Guaranteed.

Send us your INQUIRIES *for* ALL POWER MACHINERY

CHARLES B. REARICK 30 CHURCH ST. NEW YORK 7, N. Y.

WATER TUBE BOILERS

Union Iron Works Horizontal Straight Tube

2—259 H.P., single drum

2—350 H.P., two drum

First-class condition
Immediate delivery

JAMES T. CASTLE CO., INC.
534 FIRST AVE.
PITTSBURGH 19, PA.

FOR SALE
USED HYDRAULIC PUMPS
ONE ALDRICH VERTICAL

3 cylinder 8"x10" capacity 500 GPM 350 PPI driven by GE synchronous motor, 125 HP, 2300 volts, 60 cycle, 3 phase.

TWO BLAKE HORIZONTAL

4½x15" capacity 228 GPM, 1000 PPI driven by GE synchronous motor, 175 HP, 2300 volts, 60 cycle, 3 phase.

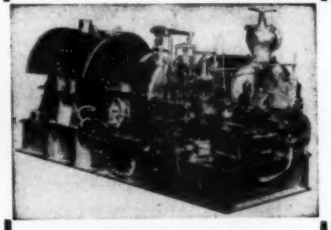
J. I. CASE COMPANY
BETTENDORF, IOWA

MOTOR & PUMP — SAVE 50%

200 HP G.E. Induction Motor, 1745 RPM, 3/60/2200, Model No. 11-c-56, Serial 4819352; with grids, starter. 2,000 GPM Gould Centrifugal Pump, Head 230', Serial No. 131499. PERFECT CONDITION.

UNITED STEEL PRODUCTS CO.
PO Box 4111 Phone 8-6509 Memphis, Tenn.

FOR SALE
TURBO GENERATORS
USED — GOOD CONDITION



GE 200 KW 120V
ALSO AVAILABLE:
132 KW, 200 KW, 500 KW, 3/60/450 AC

•

1500 HP DC MOTORS WESTINGHOUSE

•

1200 KW DC GENERATORS —ALLIS CHALMERS

•

DIESEL DIVISION
NATIONAL METAL & STEEL CORP.
Dept. P, Terminal Island
(Los Angeles Harbor), Calif.
Phone Los Angeles: Nevada 6-2517

MOTORS — M.G. SETS — TRANSFORMERS

SQUIRREL CAGE MOTORS
3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1	400	G.E.	IK	2300	514
1	400	G.E.	KT-412	2300	435
2	300	Whse.	CR-690	2300	1760
1	200	Whse.	CR-675C	2300	1160
1	200	Al.Ch.	AR	440/220	580
2	125	Al.Ch.	AR	2200	1750
1	125	Whse.	CR-761C	440/220	1750
1	125	C.W.	126-G	440/220	450
2	100	Whse.	CR-683C	440/220	1760
1	100	G.E.	IK	440/220	1800
1	100	Al.Ch.	AR	2200	1160
1	100	Al.Ch.	AR	550	690
1	100	F.M.	M241B	440/220	435
1	100	Whse.	CR-938	2200	495
1	75	G.E.	I-E15	440/220	870
1	75	Al.Ch.	AR	2200	1765
1	75	Al.Ch.	AR	2200	1750
1	75	Al.Ch.	AR	2200	690
1	60	G.E.	KT	440/220	1160

SYNCHRONOUS MOTORS
3-Ph., 60-Cy.

Qu	HP	Make	PF	Volts	RPM
1	8000	Whse.	80	4800/2400	720
1	700	G.E.	80	2300	720
1	600	Whse.	80	2400	720
1	400	Whse.	80	440	600
1	300	Whse.	80	440	514
1	150	G.E.	100	2200	900
1	150	G.E.	100	550/2200	600
1	150	G.E.	80	550/2200	450
3	125	Kl.Mohy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440/220	1800
1	100	Whse.	100	2200	1200
1	100	Ideal	80	220/440	900
2	100	G.E.	80	220/440	600

SLIP RING MOTORS—CONSTANT DUTY—3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1**	3000	G.E.	MT	2200	256
1**	1500	C.W.	BR	2300	257
3**	1000	Al.Ch.	AMT	2300	514
1**	800	G.E.	MT-20	2300	360
1	600	Whse.	C.W.	4600/2300	514
1	500	Al.Ch.	ANY	4000/2300	514
1**	400	Al.Ch.	ANY	2200	514
2	500	G.E.	I-16-M	2300	450
3	400	G.E.	MT-412	2200	450
1	300	G.E.	I-15-M	2200	1200
1	300	Al.Ch.	ANY	2200	514
1	250	G.E.	MT-414	2200	300
1	200	G.E.	I-16-M	2200	585
1	150	G.E.	I-13-M	2200	1750
1*	125	Whse.	CW-870	2300	870
1	100	F.M.	H20C	440/220	900
1	75	G.E.	IM	440/220	695
1	75	Whse.	CW-7549	440/220	690

**Mill type pedestal bearing. ***3 bearing.

MOTOR GENERATOR SETS

Qu	KW		Make	RPM	Volts DC	Volts AC
1	2400	3U	Al.Ch.	720	825	4800/2400
1	1500		Whse.	514	250	4600/2300
2	1000		G.E.	514	575	4000/2300
1	500	3U	Whse.	1200	120/240	2300/440
2	500		C.W.	720	575	4000/2300
1	500		C.W.	720	250/275	4000/2300
1	500		C.W.	720	250/275	2300/440
1	200		Ridgway	900	250	2300
1	155		G.E.	720	250	2300/440
1	150		G.E.	1200	500	2300/440
1	100		Ridgway	1200	275	4000/2300
1	85		C.W.	1200	250	2300/440
1	75		Star	1200	230	440/220
1	75		Al.Ch.	900	250	2300
1	50		Burke	1800	240	440/220
1	30		Reliance	1800	250	440/220
1	25		Whse.	1200	120/240	440/220
1	20		Reliance	1800	250	440/220

(3U—3-unit set.)

TRANSFORMERS (Power)

Qu	KVA	Make	Type	Phase	Voltage
1	7500	G.E.	H	3	23000/29700-13800/12600
3	1500‡	Gregory	(X)	3	4160-480
3	250	Packard	OISC	1	13200-2200
3	150	G.E.	H	1	19000/9500-440/2300
3	100	Whse.	88	1	12075/10955-230/460
3		G.E.	HT	1	33000/2400
3	50	Al.Ch.	OISC	1	22000-220
2	50	Wagner	BE	1	13200/11880-575/287
3	50	Pena	OISC	1	2400/4160-Y-120/240

(X) New, selfcontained, indoor type, air cooled.

DIRECT CURRENT MOTORS

Qu	HP	Make	Type	RPM
1***	3000	Whse.	Encl.(Rev.)	600
1***	2400	Whse.	Encl.(Rev.)	600
4***	1500	Whse.	Encl.(Rev.)	600
4***	1200	Whse.	Encl.(Rev.)	600
4***	800	Whse.	Encl.(Rev.)	600
1	350	G.E.	CD-169	1150
1	325	Whse.	QM-660.6	450/900
1	200/250	El.Dy.	422	400/1200
1***	200	G.E.	MPC	800/1200
1	200	Whse.	Mill	300/1200
1	300	Whse.		240/900
1	180	G.E.	MPC	400
2*	180	C.W.	83-H	890
1***	125	Whse.	SK-190	600
1	100/125	Rel.	1995-F	300/1200
2	100	Rel.	1050-T	400/1200
1	90/160	G.E.	MPC	625/1125
1*	80/75	Rel.	1995-F	300/1200
1	35	G.E.	RF-14	500/1600
1	35	G.E.	CD-125	480/1200
1	35	G.E.	CD-147	300/1200
1	35	Rel.	35P	240/1600
1	32½	Whse.	SK-150	400/1200
1*	30/75	Whse.	SK-151L	400/1200
1	30	Al.Ch.	E-145	400/1200
1	30	G.E.	CDM-105	575/1750
2	27½	El.Dy.	158	450/1350
1	25	G.E.	RF-13	400/1600
1	25	G.E.	CD-123	400/1200
1	25	Whse.	SK-140	400/1200
1	25	Whse.	SK-111L	250/1000
2	20	Al.Ch.	E-130	400/1200
3	20	G.E.	CD-123	300/1200

All above 230-VDC except where marked ***.
*** Pedestal bearing mill design 525/600-VDC.
(Rev.) Designed for mill reversing service.
* T.E.F.C.

T. B. MAC CABE COMPANY

4314 CLARISSA STREET — Phone DAvenport 4-8300 — PHILADELPHIA 40 PENNA

FOR SALE

Two 7" Steel Boiler Angle Valves

Non-return type for 250 lb. working pressure. Valves have been in service short time.

STANDARD BREWING CO., INC.
440 Lake Avenue, Rochester 6, New York

FOR SALE

25 K. W. Diesel Power Unit; Output 220 V., 3 Ph., 60 Cy. Powered by Cummins Diesel. 4.8 hrs. actual running time. Like new.

J. P. DAVENPORT CO.
124 N. Galt Avenue, Louisville 6, Ky.
Phone—Taylor 5938

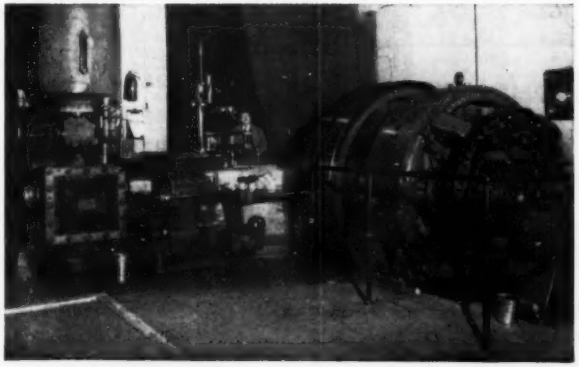
FOR SALE

COCHRANE OPEN TYPE FEED WATER HEATER

800 H.P.—Equipped with all New Trays.
Priced Low for Quick Sale.

VALVE & SUPPLY CO.
378 Bedford Ave., Brooklyn, 11, N. Y.

ENGINE GENERATOR SET . . .



300 K.W. Crocker Wheeler 250 Volt D.C. Generator, Size 170-DA, Type CCD 200 RPM, 1200 Amp., Direct connected to Skinner 20"x 24" Counter-flow Engine 150 lb. Pressure, Oil-Filter, Water Condenser, New 1938. Dismantled & Ready for Shipment.

Excellent Condition

L. J. HOY - - - - TOLEDO 2, OHIO

122-126 NEBRASKA AVENUE - - - - - - - - - - - ADAMS 1914

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
500	2200	G.E.	450
450	440/220	Whse.	514
400	2200	G.E.	1200
350	2300/440	G.E.	450
300	440	Whse.	2000
250	440/220	Whse.	600
250	2200/550	G.E.	450
250	550/440	G.E.	1200
200	440	G.E.	450
200	440	G.E.	450
150	4000/2300	G.E.	1800
150	440/220	Whse.	600
150	440/220	Whse. (2)	1800
145	4000/2300	G.E.	1800
125	550/440	G.E.	1200
100	440/220	G.E.	600
100 (2)	440/220	Whse.	900

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	600
250	4000/2300	El. Mchy.	Syn.	600
240	2300/440	G.E.	ATI	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

PLATING UNIT

1—5,000 amp., 4/6 volt (or 2,500 amps., 8/12 volts) A.P. Munning, double commutator, dir. conn. to 50 hp, G.E. sq. cage motor.

CIRCUIT BREAKERS

2—2000 amp., GG E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse., 3 pole, 600 v., air
1—400 amp., 37000 v., G.E., Type FHKO-238 outdoor type, high interrupting capacity.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	440	G.E.	FT	3600
500	2200/4000	Elliot	SC	1800
350	2300	G.E.	KT	1200
300	2200	G.E.	FT	3600
250	440	G.E.	IK	720
200	440	G.E.	IK	514
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
200	2200/440	G.E.	KF	720
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
200	440/220	G.E.	IK	450
150	440/220	Whse.	CS	900
150	440/220	G.E.	IK	450
100	2200/550	Whse.	CS	900
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTF	1200
150	440/220	G.E.	IK	514
150	2200/440	G.E.	KT	600
100	2200/440	G.E.	K	1200
75 (5)	550	G.E.	KF	1800

A. C. GENERATORS

1—320 kva, 600 rpm, 2300/440/230 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 230/440 v., G.E.
1—225 kva, 720 rpm, 2300/440 v., G.E.
1—150 kva, 900 rpm, 480/240 v., G.E.
2— 75 kva, 1800 rpm, 480/240 v., Whse.
1— 50 kva, 1200 rpm, 440/220 v., G.E.

D. C. MOTORS

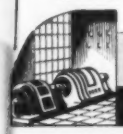
HP	Volts	Make	Type	Speed
350	230 (2)	G.E.	CD	1150
250	230 (2 new)	Cr. Wh.	CMC	1800
150	230 (3)	Whse.	SK	850
150	230	Cr. Wh.	TEFC	900
100	230	Cr. Wh.	CMC	850
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

1—100 kw, 1200 rpm, 240/120 V., Al. Chal., conn. to 150 hp, 440 V., sq. cage.
1—100 kw, 250 v., Hertner, 1200 rpm, connected to 150 hp, 220/440 v., synchronous
1—75/90 kw, 250 V., 1200 rpm, G.E. conn. to 135 hp, 440/220 V., sq. cage
1—75 kw, 125 v., 1200 rpm, G.E. conn. to 120 hp, 2200/440 v., syn. motor.
1—65 kw, 1200 rpm, 250 V., G.E., conn. to 100 hp, 1200 rpm, 440 V., synchronous
1—50 kw, 250/125 V., 1200 rpm, 3-wire, G.E., conn. to 75 hp, 440/220 V., sq. cage

TRANSFORMERS 60 CY.

2—333 kva, G.E., 13,200—2300 V.
2—333 kva, G.E., 4600/2300—230/460 V.
3—300 kva, Whse., 13200—440 V.
3—250 kva, Whse., 11,000/22,000—2300 V.
3—250 kva, Whse., 2300—240 V.
3—200 kva, Whse., 13,200—2300 V. (Inerteen)
4—200 kva, Maloney, 2400—230/460 V.
3—150 kva, Whse., 2400—240/480 V.
3— 75 kva, Maloney, 4150—240 V.
2— 75 kva, G.E., 2400—240/480 V.
6—150 kva, Al. Chal. 2400—240/120 v.
1—150 kva, Whse, SK, 13200-125/215 v., 3 ph.
2— 75 kva, G.E., 480—240/120 v., Pyranol
3— 50 kva, G.E., 480—240/120 V., Pyranol



STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

FOR SALE—DIESEL ENGINES

One Enterprise Model DSQ-6, 16 x 20 Diesel Engine. 797 HP, 327 RPM. Direct connected to Elliott AC Generator 800 Kw 50° C. rise continuous. 2400 volts, 3 phase, 60 cycle, with all necessary switch gear and Maxim steam generating silencer. Used 14,275 hours.

One Enterprise Model DSQ-8, 16 x 20 Diesel Engine. 1075 HP, 327 RPM. Direct connected to Elliott AC Generator 1000 KVA, 800 Kw, 2400 Volt, 3 phase, 60 cycle, with all necessary switch gear and Maxim steam generating silencer. Used 17,423 hours.

One Fairbanks-Morse Model 32-E-14 x 17 Diesel Engine. 300 HP, 300 RPM. Direct connected to Generator, type TGZ-6, 250 KVA, 3 phase, 60 cycle, with all necessary switch gear and silencer. Used 27,000 hours.

NYLEN PRODUCTS COMPANY

St. Joseph, Michigan

FOR SALE

SLIP RING MOTORS, 3 Phase, 60 Cycle

1—35 HP	West. CW	638A	1200 rpm
1—25 HP	West. CW	644	1200 rpm
1—15 HP	G.E. 1-M		680 rpm
1—75 HP	ITC, Hoist		900 rpm
1—30 HP	West. HF		690 rpm
1—40 HP	MT	532	900 rpm
1—30 HP	MT	336	900 rpm
5—20 HP	MT	522	900 rpm
3—30 HP 2200 volt	MT	536Y	900 rpm
1—20 HP Ideal Type AY, Frame 120			1200 rpm
1—25 HP G.E. M, Frame 444, near new			900 rpm
1—25 HP Triumph, Type C22, 2200 volt			1200 rpm
2—30 HP G.E. 2200 V.			600 rpm
2—30 HP West. C1, 220/440 Hoist			900 rpm

Many other items of large Slip Ring and Squirrel Cage Transformers, M. G. Sets and Miscellaneous Equipment.

E. P. DIETRICK

829 Richmont St. Scranton, Pa.

FOR SALE

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Two (2) Motor Generators consisting of G.E. Syn Motor, 200 HP, 208 Volts, 3 Phase, 60 Cycle, 1200 RPM, 443 Amp. and G.E. DC Generator 125 KW, 500 Amp, 125/250 Volt, complete with Starting and Control Equipment. Operating at present in Large Government Building.

May be seen if desired.

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FOR SALE

BOILER

Brand New

70 HP Superior Steam Generator 15 lb. design pressure, equipped to burn #5 oil, fully automatic, on original skids.

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PHILADELPHIA 23, PA.

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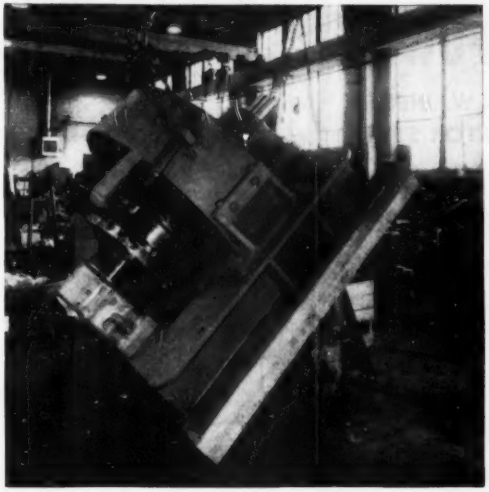
IMMEDIATE DELIVERY

Type MRO, 8 Retorts Continuous Steam Dump.
Width 14'-0". Length 14'-8"
Grate Area 205.8 sq. ft.
Steam-Electric with Lewellen Drive.

Like new. Used only 6 months. Low Price.

AUTOMATIC COMBUSTION EQUIPMENT CO., INC.

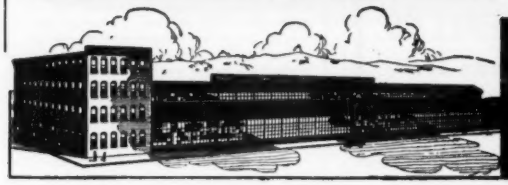
P. O. Box 1478 Rochester 3, N. Y.



UNUSUAL!!

Running—being tested—at a 45° angle to meet the requirements of an east coast dredging company. This 500 HP, 300 to 600 RPM, 230 volt, direct current Westinghouse motor was rebuilt and redesigned by Glow Electric Company to meet the customer's requirements. Some of the special features were thrust carrying roller bearings and extra heavy fabricated steel base.

You have problems, too, in connection with your electrical equipment. Whether it's locating it, or special applications, may we have the opportunity to help you?



GLOW ELECTRIC CO.
927 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024

COMPRESSOR: Worthington 2 stage, 29/18-½x 21, 600 H.P. synchronous motor, 3 phase, 60 cycle, 440 volts, 180 RPM, 100 lbs. pressure, 3000 CFM, complete with auxiliary equipment. In operation now, available immediately.

DIESEL MOTOR: 122 H.P. Caterpillar D13000 complete with clutch, V-belt pulley, and spare parts.

DRAG SCRAPERS, CRESCENT BUCKETS: 1—Sauerman 2 yd. Drag Scraper outfit complete, without 75 H.P. motor. 1—Sauerman ¾ yd. capacity complete with 30 H.P. motor. 1—Sauerman 1 yd. capacity complete with diesel motor.

BOILERS: 2—Erie City 125 H.P., self-contained, Economic type, 150 lbs. pressure, oil fired, complete, built 1945, like NEW. 2—220 H.P., 160 lbs. pressure, National Board, 3 drum, low head, complete.

A. J. O'NEILL
Lansdowne, Pa.
Phila. Ph.: Madison 3-8300—3-8301

BOILERS—TURBINES

1—10,000 KW turbo generator complete with surface condenser.

1—65,000 lbs. per hr. 450 lbs. pressure sectional steel header, 4" straight tube type boiler.

3—750; 3—600; 2—400 HP B&W vertical forged steel sectional header, 200 lbs. pressure water tube boilers.

1—Unused 140,000# per hour Combustion Engineering VU Type ASME Code 450# working pressure.

A full stock of power and distribution transformers, switch gear, including potential and current transformers, circuit breakers etc. at reasonable prices.

We buy entire central station and power stations.

We do our own rigging and dismantling.

HOWE BROTHERS
342 MADISON AVENUE Murray Hill 2-8562 **NEW YORK 17, N. Y.**

TRANSFORMERS

SINGLE PHASE—60 CYCLES (unless otherwise stated)

QTY.	KVA	MAKE	TYPE & FORM	PRIM. VOLTS	SEC. VOLTS
3	1250	GE	H—VDDG	13800	575/600
1	500	GE		4160	120/208
1	250	GE (3 PH)	HT—R	460	216Y/125
3	200	PITTS.	ODSC	2300	575
4	200	PITTS.		4150	460
2	200	WEST.	S	2400/4160	600
3	200	MOLONEY		575	230/115
1	150	GE	H—KF	2400/4160Y	240/480
1	150	PITTS.	ODCS	132000	2300
1	150	GE	H—KFA	2400/4160Y	600
1	100	A. CHALMERS	ODSC	6000/11430Y	2300
1	100	PITTS.	ODSC	13200	6000/11950Y
2	100	WAGNER	HE	3980	115/230
3	75	WEST.		2300/4160Y	120/240
3	50	GE	H—KF	440	110/220
2	50	WEST.	SK	22000	2300
3	25	PACKARD	A	2300	230/460

MANY OTHERS IN STOCK—YOUR INQUIRIES WILL RECEIVE OUR PROMPT ATTENTION
EMPIRE ELECTRIC COMPANY, INC., 37 Jay Street, Brooklyn 1, N. Y.—MAin 4-5900

DIESEL GENERATOR UNITS

100 KW. 125 KVA. 220 or 240 Volts
Quick Delivery and Complete Installation with all Equipment
LIEFKE, 57-25 COOPER AVE.
Brooklyn 27, N. Y. HEgeman 3-4335

FOR SALE

2—Late 2000KW GE Turbo Generators
2—4000 HP Sync. Motors—257 RPM
1—Rotary Compressor 60000 CF/H 4#
1—IR Compressor 20,000 CF/H @ 100#

Utility Equipment & Construction Co.
216 So. LaSalle Street, Chicago, Ill.

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100 KW GENERATOR SET

BUCKEYE DIESEL 400 RPM 3/60/240 with V-Belted exciter, Switchgear, Voltage Regulator, Oil filter, Silencer, Water Pump. Engine overhauled.

Immediate delivery—Priced to Sell

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418 S. Pears—Lima, Ohio Tel. 42867

ELECTRICAL CABLE

- for every industrial and power application
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL WIRE AND CABLE CO.
2668 N. Clybourn Ave., Chicago 14, Ill.

TRANSFORMERS

KVA	Make	Voltages Pri. Volts	Sec. Volts
1500	GE	2200	600
1250	GE	13800	575/600
1000	GE	66000	7200/7025
1000	West.	2200	220
750	West.	13800	460
750	GE	2300	2300
500		4600	460
500	West.	12000	480/240
500		4600	230/460
500	GE	4160	480
500	GE	4160	480
500	West.	2400	
500	GE	2400	240/480
500	GE	2300	230/460
500	Uptegraff	12000	2300
500	GE	34500	230/460
450	GE	23000	445
450	Uptegraff	11000	460
400	GE	2400	480
333	GE	4150	120/240
333	Packard	2400	480
300	Pitts.	2300	115/230
250	Pitts.	4600	460
250	GE	460	216Y/125
250	Pitts.	2400	600
250	West.	2400	460
250	West.	463	
250	West.	13800	230/115
200	Moloney	600	220/110
200	West.	13200	2300
200	GE	4156	240/120
200	GE	495	120/240
200	GE	2200	122/244
200	Penn.	2400	480
200	Moloney	2400	230/460
200	West.	2300	600
200	Pitts.	2300	600
200	GE	11500	460
200	West.	3984	115/230
200	GE	6900	2400
150	Packard	4600	230/115
150	GE	2400	240/480
150	Pitts.	13200	2300
150	GE	2400	600
150	Standard	2300	230/460
150	GE	13800	115/230
150	West.	2400	240/480
150	GE	2400	240/480
150	GE	2200	110/220
150	Pitts.	7200	115/230
150	GE	4150	120/240
125	West.	440	440
125	West.	440	440
125	Al. Ch.	440	220/110
100	Pitts.	4600	230/115
100	Al. Ch.	6600	2300
100	Pitts.	13200	6900/11950Y
100	Uptegraff	4160	40
100	Pitts.	2100	110/220
100	Wagner	3980	115/230
100	West.	13200	220/440
100	Moloney	2200	110/220
100	GE	460	115/230
100	GE	18490	2400/4800
100	GE	11500	230/460
100		4600	2301
100	GE	11000	2300
100	GE	6900	2400/4160Y
100	GE	4160	240/120
100	GE	2400	120/240
100	Pitts.	2300	115/230
75	Pitts.	2400	120/240
75	Packard	460	150/230
75	GE	2400	600
75	Moloney	440	110/220
75	GE	440	110/220
75	West.	6900	115/230
75	Kuhlman	4600	115/230
75	Moloney	2400	120/240

MOTORS — MG SETS
— World's Largest Inventory —

ELECTRIC EQUIPMENT COMPANY
ROCHESTER, N. Y.
PHONE: LD-65

A. C. POWER

3—150 K.W. DIESEL GENERATOR SETS

Buckeye—600 r.p.m.—medium speed Westinghouse generator — 440/3/60 — complete with modern dead front switch gear. Units equal to new—used only 50 hours.

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Write—Wire—Phone

THE BOSTON METALS CO.
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Baltimore, Md.
LE 1900 CU 5050

SQUIRREL CAGE MOTORS
125 HP GE 3/60/440V/1800 KT547/#5235285
350 HP C.W. 3/60/2300V/3550 RPM/#1196851

SLIP RING MOTORS
30 HP GE MT342 3/60/220V/720/#4002427
40 HP GE MT346 3/60/220V/690/#4012815
50 HP West. CW 3/60/220V/1175/#2249566
100 HP GE 3/60/220V/430/Type I-16/#1578989
500 HP GE 3/60/2300V/900 RPM/#5275932

SYNCHRONOUS MOTORS w/CONTROLLERS
75 HP West. 3/60/220V/1200 RPM Sealed Sleeve Brg. w/Dir. Con. Exc.
125 HP El. Mach. 3/60/4800V/900 RPM Ball Brg. w/Dir. Con. Exc.
135 HP GE 3/60/4000V/1200 RPM/T5963Z
175 HP Burke 3/60/2200V/720 RPM w/Dir. Con. Exc.

MULTI-ARC WELDING M-G SETS
24-GE 1500 Amp. Synchronous driven w/AC & DC Panels

DIESEL ENGINES

TURBINE GENERATORS—M-G SETS
4-New Hercules 135 HP Mod. DWXD
250 KVA Elliot Turbo Gen. 3/60/208V/1200 RPM/Equal to Unused
100 KW AC-DC 240V 4 Brg. Ball Brg. M-G Set
100 KW GE Alt. 3/50-60/1500-1800 RPM/Type ATI/2 Brg. 4 Wire w/Dir. Con. Exc., Unused

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210 Snediker Ave., Brooklyn 7, N. Y.

BOILERS

2—750 H.P. 200# WP Sterlings Located on Gulf of Mexico with new tubes.

2—250 H.P. 200# WP B & W Sectional Steel Headers. Located Toronto, Canada. Including Stoker and Stack.

1—1949 Combustion Engineering Spreader Stoker complete with Hagen controls and Board. Designed for 50,000 lbs. steam per hour, properly dismantled and boxed. AVAILABLE IMMEDIATE SHIPMENT.

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4 ton bucket hoist—3 motor high speed, with 2-4 wheel swivel trucks and Williams standpace bucket with safety catches
Coke Bucket
Hoisting cables

SPARE PARTS FOR HOIST
40 H.P. 440 volt 3 phase motor
30 HP. 440 volt 3 phase motor
Torque motor 440 volt
Miscellaneous small parts

Available Immediately

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APPLETON, WISCONSIN

DIESEL ELECTRIC GENERATING PLANT

For sale alternating current Diesel Electric generating plant used not more than 10 yrs. Complete with 2 engine generators, each engine rated 125 HP with direct connected generators, belt driven exciters, intake silencers, cooling system water recirculating pumps, gages, fans, fuel oil system with pumps, automatic controls and alarms, switchboard with oil circuit breakers and voltage regulators. Plant is in N. Y. C. and is offered as is—where is.

FS-1933, POWER
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PULVERIZER
B. & W. E-26 Class 221B
6000 pounds per hour
55 Grindability
UNUSED

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Air Compressors—3000-800 motor two 500cfm driven by diesels. Motor generator sets all sizes. Mercury arc rectifier 1000kw rotary converters—transformers—plating sets—dynamometers. Boilers—low head 1000-400-300, 3 drum also furt 78 by 20 250kw exciter—frequency changers—oil circuit breakers. Tanks—100,000 water storage. 4000 bbl. and 50,000 oil. Foamite. Stacks 72 by 200—40 by 70—28 by 50—20 by 60. H. A. Woodworth, 611 Olive St., St. Louis, Mo. Main 1071

260 H. P. DIESEL ENGINE

Liquidation Sale—Twin 6—71 General Motors model 12103. Heavy duty reduction gear to 900 R.P.M. With starting batteries and silencers. A standby unit used 4500 hours.

MARTIN J. HANSON TRUSTEE
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580 H.P. WESTINGHOUSE INDUCTION MOTOR TYPE C
2200 V/3/60, 500 rpm
Direct Connected to:
400 KW WESTINGHOUSE
600 V DC GENERATOR

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AVAILABLE AT ONCE
COMPLETE BOILER PLANT

160# pressure including 308 HP boiler three drum type, spreader stoker, stack, feed pumps, feed water heater, F.D. Fan, all piping and auxiliaries.

Also 100 ton stave silo, elevator and complete Coal Handling System. Coal handling for sale separately or with boiler plant.

FS 1866 POWER
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THIS MAN WOULDN'T NEGLECT

A MACHINE IN HIS PLANT

...yet he hasn't had a Chest X-Ray!

He checks every piece of mechanical equipment he owns for wear, lubrication, efficiency.

Yet he fails to take the simple precaution of a Chest X-Ray to make sure he does not have tuberculosis. *Not because he's opposed to the X-Ray. Simply because he is not sufficiently informed—or just hasn't taken the time and trouble, or does not realize the seriousness of the problem.*

A Chest X-Ray is the first step toward detecting tuberculosis in its early stages. And in its early stages it can be cured with the least loss of time from work.

So, if you're the man above, that one simple reason should make you get your Chest X-Ray—*today*. But listen, see how serious this really is:

Between the ages of 15 and 34, tuberculosis leads all other diseases as a cause of death—although at no age are you safe from TB. Yet, if everyone does his part by getting a Chest X-Ray periodically, and the majority of cases thus discovered are followed up, we can eliminate TB entirely as a public health hazard!

Will you do your part today? **Get a Chest X-Ray. It may mean your life!**

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POINTS TO CHECK ✓

IN YOUR COOLING TOWER INVESTMENT

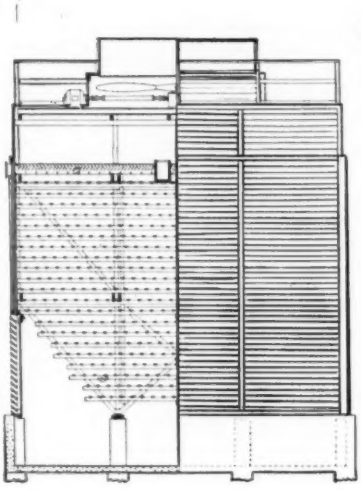
Here's what you get with a *C.H. Wheeler* Cooling Tower

GUARANTEED COOLING RESULTS—Names of installations near you sent on request. Repeat orders prove customer satisfaction. ✓

TWO TENTHS OF 1% DRIFT LOSS—Accurately placed Herringbone Drift Minimizers save on make-up water. ✓

MOST EFFICIENT WATER BREAK-UP—Wood fill arranged for best combination of wetted surface and water drop surface to speed cooling. ✓

NON-COLLAPSING FILL—Rugged 2" x 2" redwood members sawed diagonally—last the life of tower. ✓



GUARANTEED WIND-SAFE—Standard construction for 100 miles per hour—(75 mph is hurricane velocity). ✓

ADVANCED DESIGN PLASTIC FANS—on large towers pioneered by C. H. Wheeler—adjustable pitch blades—20-1 safety factor. ✓

CASINGS CONFORM—to architecture—to fire codes—may be many materials, including redwood, asbestos cement board, masonry, brick, properly painted steel, etc. ✓

NON-CORROSIVE ELEMENTS—Fill is slot-fitted; no nails. Nuts, bolts, etc., furnished in non-corrosive metals. Plastic fan blades. ✓

EASE OF ACCESS—into all parts of tower, *including the cooling space,* for regularity of maintenance. ✓

CUSTOM BUILT—Sure to satisfy your specific requirements. ✓

ENGINEERED FOR THE CLIMATE—50 years of successful experience in building for arid, tropical and cold areas, including severe icing conditions. ✓

INDUCED, FORCED, OR NATURAL DRAFT ✓

LITERATURE MAILED ON REQUEST ✓

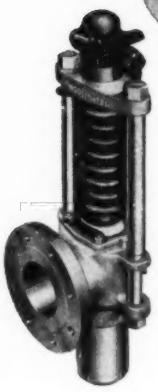
C.H. Wheeler OF PHILADELPHIA

VACUUM REFRIGERATION—COOLING TOWERS—HIGH VACUUM PROCESS EQUIPMENT—MICRO-PARTICLE REDUCTION MILLS—STEAM CONDENSERS—STEAM JET EJECTORS—MARINE CONDENSERS & EJECTORS—DECK MACHINERY

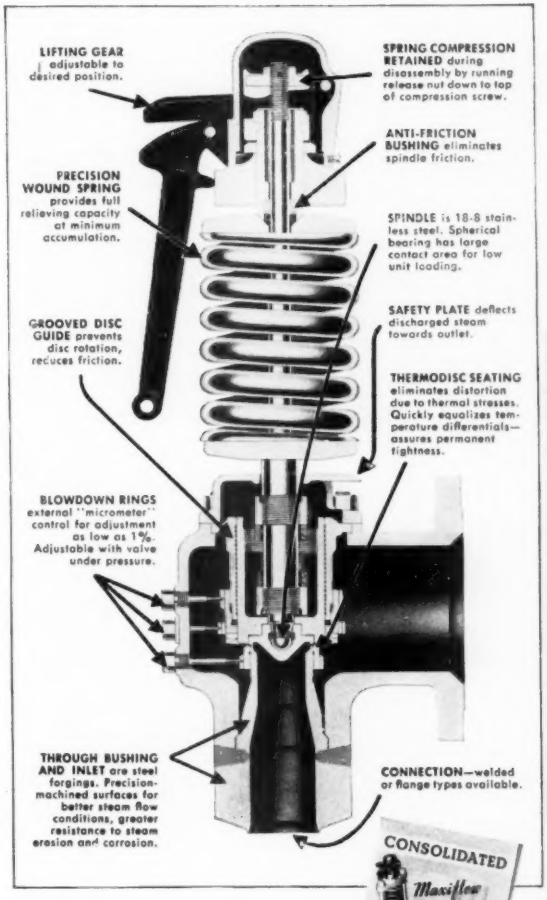
C. H. WHEELER MANUFACTURING CO., 1400 SEDGLEY AVE., PHILADELPHIA 32, PA.

REPRESENTATIVES IN MOST PRINCIPAL CITIES

FOR *Greater* DISCHARGE CAPACITY...



CONSOLIDATED *Maxiflow* SAFETY VALVE


LIFTING GEAR adjustable to desired position.
SPRING COMPRESSION RETAINED during disassembly by running release nut down to top of compression screw.
ANTI-FRICTION BUSHING eliminates spindle friction.
PRECISION WOUND SPRING provides full relieving capacity at minimum accumulation.
SPINDLE is 18-8 stainless steel. Spherical bearing has large contact area for low unit loading.
SAFETY PLATE deflects discharged steam towards outlet.
GROOVED DISC GUIDE prevents disc rotation, reduces friction.
THERMODISC SEATING eliminates distortion due to thermal stresses. Quickly equalizes temperature differentials—assures permanent tightness.
BLOWDOWN RINGS external "micrometer" control for adjustment as low as 1%. Adjustable with valve under pressure.
THROUGH BUSHING AND INLET are steel forgings. Precision-machined surfaces for better steam flow conditions, greater resistance to steam erosion and corrosion.
CONNECTION—welded or flange types available.

High-pressure, high-temperature steam generating equipment demands safety valves with greater discharge capacity. Consolidated Safety Valves first saw service in 1879. Today, every feature modern engineering can contribute is incorporated in Consolidated *Maxiflow* Safety Valves to provide the greater discharge capacity so essential in steam generating plant operations.

EXAMPLE: 2½" MAXIFLOW

Gauge Pressure P.S.I.	Capacity Saturated Steam Pounds Per Hour A.S.M.E. Rating
1200	143,700
1500	179,000
2000	238,400
2500	297,600

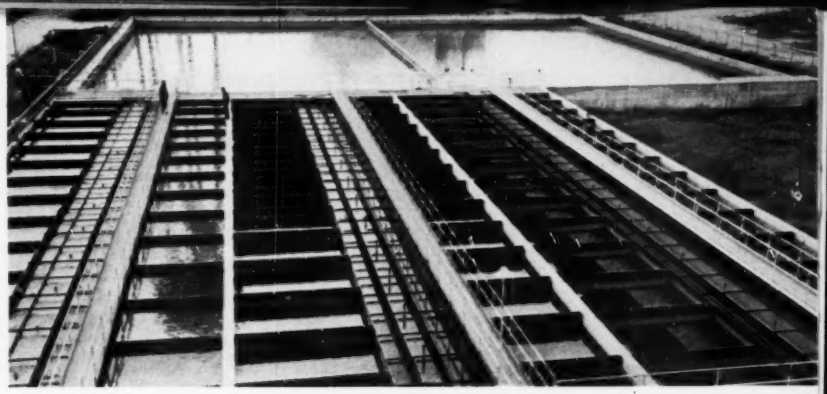
Whatever size safety valve you need in your plant—1½", 2", 2½", 3" or 4"—you can rely on Consolidated Maxiflow to discharge maximum flow, with shorter blowdown. Popping point retention is achieved by combining proper compensation with materials having low coefficients of expansion. These and many other performance features set a new standard in safety and service.

For complete data, including capacity tables, write for Bulletin 707.

CONSOLIDATED SAFETY VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES. BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.



Three Permutit Precipitators at Alcoa's Davenport, Iowa plant. Each processes 3,000,000 gallons of water a day.

How Permutit helps Alcoa get BETTER WATER...

THESE BASIC PROCESSES, PLUS PERMUTIT SKILL, CAN SOLVE YOUR WATER CONDITIONING PROBLEMS

1. SLUDGE BLANKET HOT LIME SODA. Application of the sludge blanket to hot lime soda treatment reduces silica in boiler feed make-up, produces high quality steam.

2. HOT ZEOLITE—PERMUTIT Q. Subsequent treatment of water from hot lime soda treatment yields effluent of zero hardness. Permutit Q, or styrene base mineral resistant to high temperatures, replaces second stage phosphate treatment.

3. SILICA REMOVAL PLUS DEMINERALIZATION. Demineralization by cold ion exchange processes produces water comparable to distilled water only at a fraction of the cost of distillation. Treatment by anion exchange resin, Permutit S, reduces silica to less than 0.2 ppm.

4. DEAERATING HEATER. The Permutit Deaerating Heater, utilizing exhaust or bled steam, prevents corrosion of feed lines, stage heaters, economizers, and boilers, by removing oxygen and free CO_2. Capacities from 12,000 to 1,400,000 pounds per hour are in service.

5. PRECIPITATOR. The Permutit Precipitator is used to lower alkalinity, reduce hardness, and help to remove turbidity, color, taste and odor. It can also be used to reduce silica.

with
LOW TURBIDITY
LOW OPERATING COST
LOW CHEMICAL COST
LOW WATER WASTE

Alcoa's water needs average 9,000,000 gallons per day in their Davenport, Iowa plant. A Permutit Precipitator processes all their mill use water, and yields an effluent turbidity of only 5 ppm from an influent turbidity as high as 900 ppm. Yet operating cost, including pumping, chemicals, depreciation and maintenance, is only 5¢ per thousand gallons. Of this, chemical cost is less than 2¢ per thousand. Water waste has averaged only 8.75%.

Precipitators for lowering alkalinity and removing turbidity of water are only one of many Permutit products for solving water conditioning problems. In the column at left, some of the more important basic processes are illustrated and described.

Find out how Permutit can solve *your* water processing problems. Write to The Permutit Company, Dept. P-10, 330 West 42nd Street, New York 18, N. Y., or to Permutit Company of Canada, Ltd., 6975 Jeanne Mance St., Montreal.

PERMUTIT®

WATER CONDITIONING HEADQUARTERS FOR OVER 38 YEARS